

Chapter 1 — Provisioning

Introduction

This chapter outlines the procedures required to determine equipment requirements.

Provisioning a new system

Provisioning a new system consists of:

- Defining and forecasting growth.
- Calculating number of trunks required.
- Calculating number of lines required.
- Assigning equipment and preparing an equipment summary.

Forecasting trunk and line growth

The first step in provisioning a new system is to forecast the number of trunks and lines required at two-year and five-year intervals.

The number of trunks and lines required when the system is placed in service (cutover) is determined by the customer. If the customer is unable to provide a two-year and five-year growth forecast, then an estimate of annual growth is used to estimate the number of trunks and lines required at the two-year and five-year intervals.

Calculating number of trunks required

Enter the quantity of each type of trunk required in Worksheet A. This determines the number of trunk cards required at cutover, two-year, and five-year intervals.

Calculating number of lines required

Enter the quantity of each type of analog and digital line required in Worksheet B. This determines the number of Meridian Digital Telephone TNs and Analog (500/2500 type) TNs required at cutover, two-year, and five-year intervals.

Worksheet A: Trunk Forecast

Customer: _____

Date: _____

NTMW07 Trunk/Line Card Forecast Worksheet

Trunks	Cutover	2 years	5 years
2-way			
1-way in			
1-way out			
DID			
Tie			
CCSA			
InWATS			
OutWATS			
FX			
Private line			
Dial dictation			
Paging			
RAN			
AIOD			
CO			
Total			
Divide Total by 4 = Number of NTMW07 cards needed			
Multiply number of NTMW07 by 4 = Analog lines available			
Note: Each NTMW07 Trunk/Line card is provides four trunk TNs, four analog line TNs and one power fail transfer circuit. See "Chapter 11 —NTMW07 Trunk/Line Card" for details.			

Worksheet B: Line forecast

Customer: _____

Date: _____

Digital Line TN Forecast Worksheet

Digital Telephone Line TNs	Quantity at Cutover	Quantity in 2 years	Quantity in 5 years
Attendant Console TNs (including TNs for power, see Note) See <i>Note</i> .			
Digital Telephone Line TNs			
Total			
Divide total by 24 = number of NTMW05 cards needed			
Note: See "Chapter 8 —M2250 Attendant Console" for powering options.			

Analog Line TN Forecast Worksheet

Analog Telephone Line TNs	Quantity at Cutover	Quantity in 2 years	Quantity in 5 years
Analog Telephone line (500/2500-type) TNs			
Total			
Minus 4 x number of NTMW07 cards in system			
= additional analog TNs needed			
Divide additional TNs by 16 = number of NTMW06 cards needed			
Note: Each NTMW07 Trunk/Line card is provides four trunk TNs, four analog line TNs and one power fail transfer circuit. See "Chapter 11 —NTMW07 Trunk/Line Card" for details.			

Provisioning conference channels

Conference channels

The conference function is provided by the NTMW01 Small System Controller (SSC) card. Two conference circuits are always active, a third becomes active when the expansion cabinet is equipped.

Each conference circuit supports 16 conferees. Therefore the SSC card supports a total of 32 conferees.

The Fiber Expansion Daughterboard supports an additional conference circuit. Therefore a total of 48 conferees are supported when the SSC card is equipped with a Fiber Expansion Daughterboard.

Assigning equipment and preparing equipment summary

Use Worksheet C to record the equipment requirements for the complete system at cutover. Assign the equipment. The equipment summary may have to be updated as a result of assignment procedures.

Use the finalized equipment summary (Worksheet C) to order the equipment for the system.

Worksheet C: System cabinet requirements

Customer: _____

Date: _____

Prepare one worksheet for the system at cutover, 2-year, and 5-year intervals.

PE Card Calculations Worksheet

	Cutover	2 years	5 years
Number of NTMW05 Digital Line cards			
Number of NTMW06 Analog Line cards			
Number of NTMW07 Trunk/Line cards			
Number of NTMW04 DTI cards (See Note)			
Total			
Note: See "Chapter 9 —NTMW05 Digital Line Card" for information about the DTI card.			

List the card slot assignments

Refer to [Figure 1](#) and [Figure 2](#) for card slot assignments and list them on Worksheet D.

Figure 1
Card slot assignments in Main Cabinet

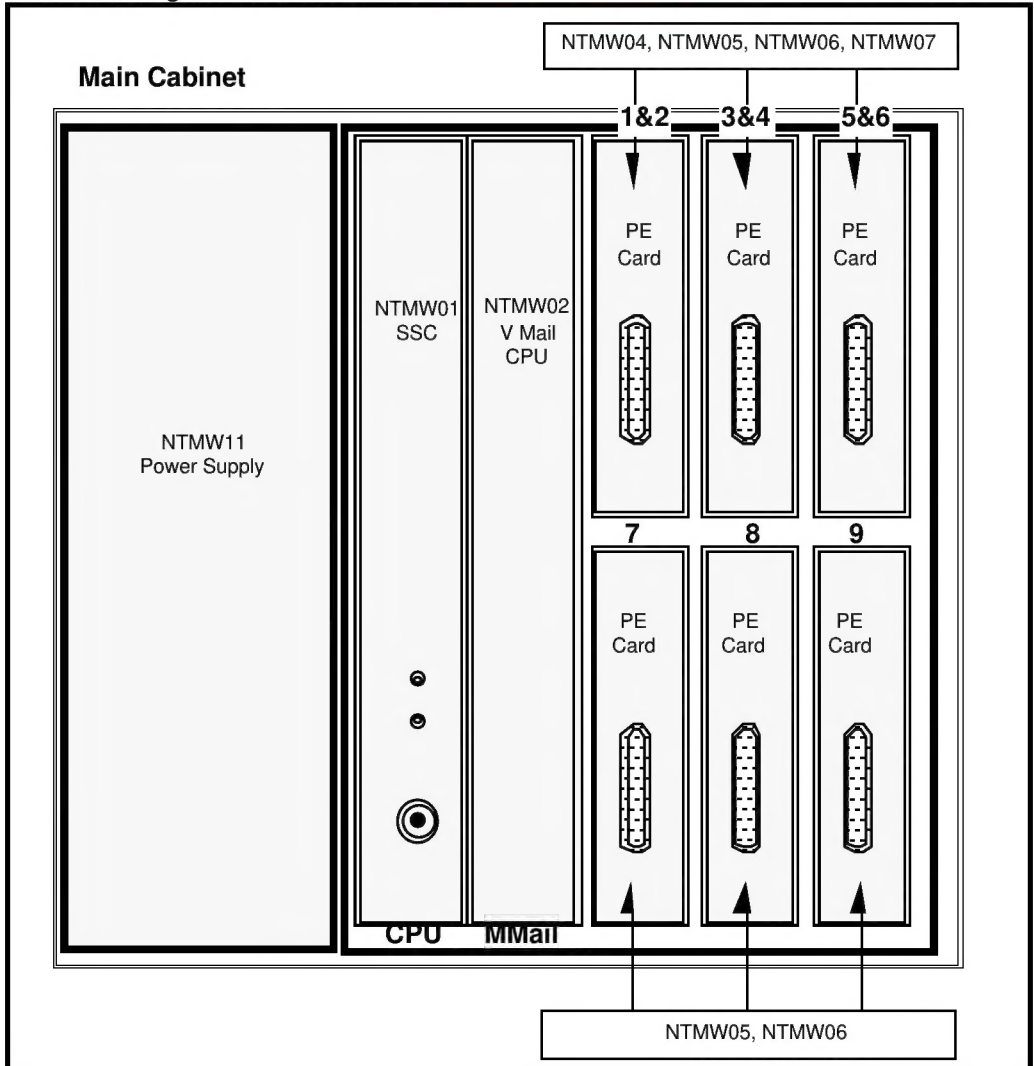
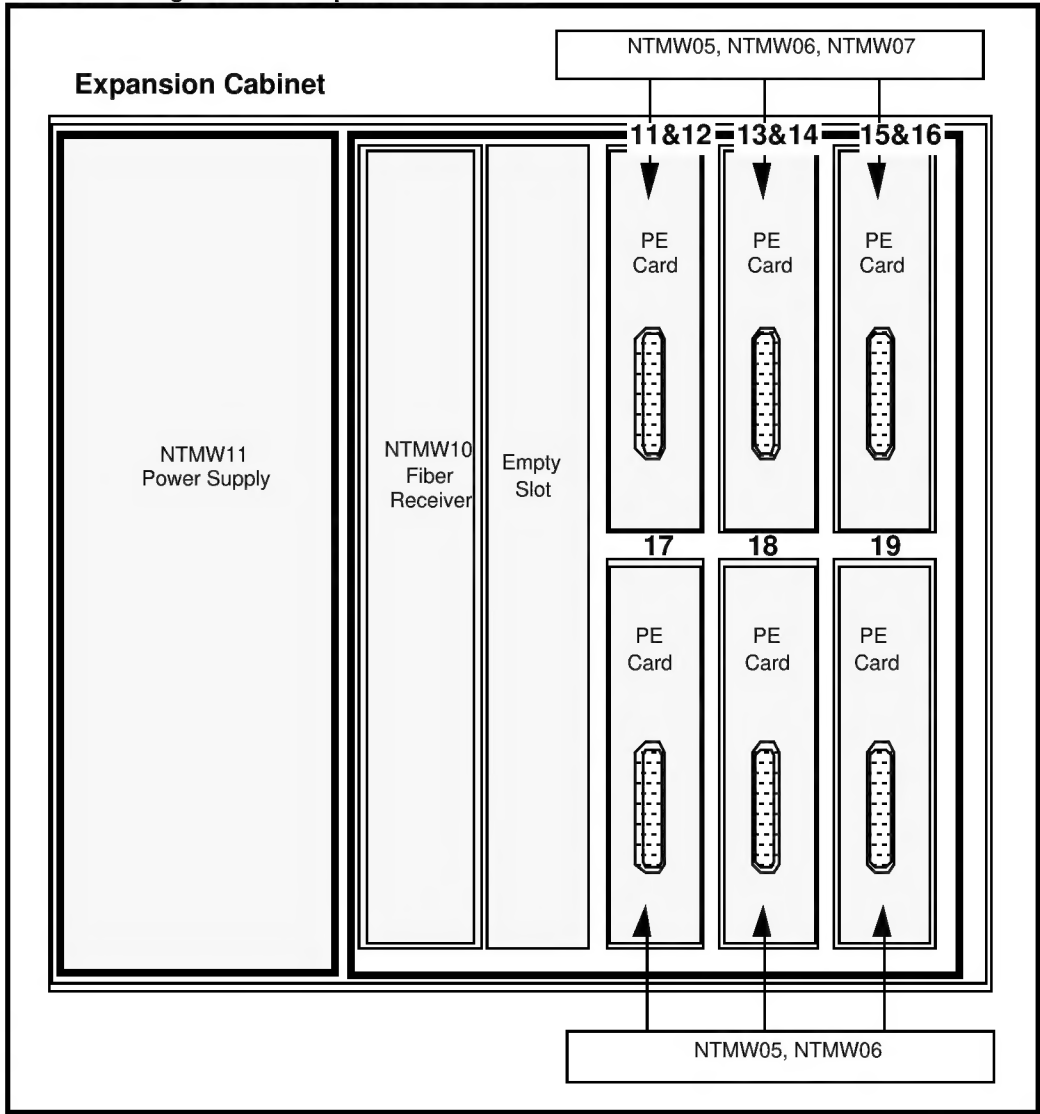


Figure 2
Card slot assignments in Expansion Cabinet



Worksheet D: Card Slot Assignments

Main and Expansion Cabinet Card Assignment		Main and Expansion Cabinet Card Assignment	
Slot Number	Card Type	Slot Number	Card Type
1 & 2		11 & 12	
3 & 4		13 & 14	
5 & 6		15 & 16	
7		17	
8		18	
9		19	
10	Mail	20	Not used

Chapter 2 — Transmission parameters

Introduction

The Meridian 1 Option 11C Compact system uses μ -Law companding to convert signals from analog to digital and from digital to analog.

Transmission characteristics are given in this chapter. Except where indicated otherwise, the design objectives given are met when measured between 2 wire and 4 wire analog input and output interfaces terminated with their nominal impedance.

The reference frequency is 1024 Hz. The reference level is -10 dBmO (as an alternative a reference level of 0 dBmO may be used).

Transmission

Loss Plan

Insertion loss

The insertion loss of a private branch exchange (PBX) connection is defined as the difference between the power delivered from the (test) reference source into the input port and the power at the output port. For insertion loss tests both the signal source and the measurement instrument have impedances of 600 ohms. The test frequency is 1024 Hz.

The insertion losses between various Peripheral Equipment (PE) ports are connection - specific in order to be compatible with end-to-end network connection loss requirements. The Option 11C Compact loss specifications are in agreement with North American standards, which are formulated to provide satisfactory end-to-end performance for connections within private networks and between private and public networks.

The loss plan strategy for PE combines electrical loss with terminal acoustic parameters for optimum transmission performance. For this reason, some connections have asymmetrical loss in order to conform with network loss plans. This asymmetry is resolved at a remote point (another switch) in the overall connection.

[Tables 1, 2](#) and [3](#) provide loss values measured in decibels (dB) for connections between:

- PE ports (lines and trunks)
- Digital ports (PRI or DTI)

[Tables 1, 2](#) and [3](#) are in matrix format; note the direction of the arrows when searching for a loss value.

Table 1
Insertion Loss from PE Ports to PE Ports (measured in dB)

	PE Ports							
	500/2500 Line		Digital Line		4 Wire (ESN) E&M Trunk		CO/FX/WATS Loop Tie Trunk	
PE Ports								
500/2500 Line								
→	6							
←	6							
Digital Line								
→	2.5		0					
←	3.5		0					
CO/FX/WATS Loop Tie Trunk								
→	2.5		0		0		0.5	
←	0		-3.5		-0.5		0.5	

Table 2
Insertion Loss Digital Ports To PE Ports (measured in dB)

	PE Ports					
	500/2500 Line		Digital Line		CO/FX/WATS Loop Tie Trunk	
Digital Ports						
Tie Trunk						
→	8.5		6		2.5	
←		2.5		0		-2.5
Satellite Tie Trunk (See Note 1)						
→	2.5		-3		-0.5	
←		2.5		0		-0.5
CO/FX/WATS Loop Tie Trunk						
→	0.5		2		0.5	
←		4.5		-1		-0.5
Toll Office (See Note 2)						
→	8.5		6		5.5	
←		2.5		0		0.5
Primary Rate Interface (PRI) (See Note 3)						
→	6.5		6		2.5	
←		3.5		0		-2.5

Notes to [Table 2](#)

Note 1: A satellite tie trunk connects a satellite or tributary PBX to a main PBX. A tributary PBX does not have its own directory number for incoming calls.

Note 2: The toll office designation is for a trunk to an office in the public switched network with a higher rank than the local office (class 5).

Note 3: The 1.5Mb PRI and DTI have digital pads which are controlled by Option 11C Compact software to provide the insertion loss given in [Table 2](#).

Table 3
Electrical loss Digital ports to Digital ports (measured in dB)

	Digital ports									
	Tie Trunk		Satellite Tie Trunk (See Note 1)		CO/FX/WATS Loop Tie Trunk		Toll Office Trunk (See Note 2)		Primary Rate Interface (PRI) (See Note 3)	
Digital Ports										
Tie Trunk										
	0									
	0									
Satellite Tie Trunk (See Note 1)										
	0		0							
	0		0							
CO/FX/WATS Loop Tie Trunk										
	0		0		3					
	6		0		3					
Toll Office (See Note 2)										
	0		6		6		0			
	0		0		0		0			
Primary Rate Interface (PRI) (See Note 3)										
	0		6		3		0		0	
	0		0		0		0		0	

Notes to [Table 3](#)

Note 1: A satellite tie trunk connects a satellite or tributary PBX to a main PBX. A tributary PBX does not have its own directory number for incoming calls.

Note 2: The toll office designation is for a trunk to an office in the public switched network with a higher rank than the local office (class 5).

Note 3: The 1.5Mb PRI and DTI have digital pads which are controlled by Option 11C Compact software to provide the insertion loss given in [Table 3](#).

Insertion loss limits

[Table 4](#) gives the analog insertion loss limits for trunk and line connections.

Table 4
Insertion loss limits

Connection	Insertion Loss Variation Limits (dB)
Line — Line	± 1.0
Line — Analog Trunk	± 0.7
Line — Digital Trunk	± 0.7
Analog Trunk — Analog Trunk	± 0.7
Analog Trunk — Digital Trunk	$+0.7$
Digital Trunk — Digital Trunk	± 0.2

Frequency Response

Frequency Response (Attenuation Distortion) at a given frequency is the difference between the loss at the test frequency and the loss at the reference frequency. [Table 5](#) gives the frequency response for 2 wire interfaces.

Table 5
Frequency Response

Frequency (Hz)	2 Wire Interface	
	Minimum	Maximum
200	0	5
300	-0.5	1.0
3000	-0.5	1
3200	-0.5	1.5
3400	0	3.0

Notes to [Table 5](#)

- The symbol (+) denotes a loss and the symbol (-) denotes a gain.
- Reference Sources:
1024 Hz -10 dBmO

Input Impedance and Balance Impedance

Input Impedance for a port is the impedance as seen looking into the port from the tip and ring.

The Balance Impedance is the output source impedance of the port and is designed to match the impedance of the transmission line plus the far end trunk.

Table 6
Input impedance/balance impedance

Connection	Input Impedance	Balance Impedance
500/2500 Line	600	600
DID/DOD/LOOP TIE Trunk	600/900	600/3COM (3 COM is the EIA termination of $350 + 1000//0.21 \mu F$)
C.O.Trunk	600/900	600/3COM (3 COM is the EIA termination of $350 + 1000//0.21 \mu F$)

Return Loss

The return loss measures how closely the input impedance matches the required impedance (source impedance). Return loss at an impedance discontinuity in a transmission path is the ratio (in dB) of the power level of an incident signal to the power level of the resulting reflected signal.

Echo Return Loss (ERL) is a weighted average of the return loss value over the frequency range of 500 to 2500 Hz.

Single Frequency Return Loss (SFRL) is the lowest value of return loss in the frequency range of 200 to 3200 Hz.

The return loss is measured against its characteristic input impedance (see [Table 7](#)).

Reference Source is 0 dBmO.

Table 7
Return Loss

Interface	Echo Return Loss (dB)	Single Frequency Return Loss (dB)
2 Wire Line	>18	>12
2 Wire Trunk	>22	>17

Transhybrid Loss

The source impedance of a two wire interface must match the terminating impedance (line plus telephone set or line plus far end trunk). If the source impedance does not match, there will be a problem with stability and listener echo.

The values for the transhybrid (return) loss of a 2 wire interface when terminated in its balance impedance is given in [Table 8](#).

Reference Level is 0 dBmO

Table 8
Transhybrid loss

Input Frequency (Hz)	Transhybrid Return Loss (dB)
300	16
500	20
2500	20
3400	16

Idle Channel Noise

Idle channel noise is noise in the absence of a signal. It is the short-term average absolute noise power, measured with C-message weighting. The 3 k Hz flat measurement uses equal weighting for all frequencies in the 20-3000 Hz range. The values are shown in [Table 9](#).

Table 9
Idle Channel Noise

Connection	Message Noise dBrnC0	3 kHz dBm0
Line — Line	<20	<29
Line — Trunk	<20	<29
Trunk — Trunk	<20	<29

Impulse Noise

Impulse noise is defined as noise bursts or spikes that exceed normal peaks of idle-channel noise. Impulse noise is measured by counting the number of spikes exceeding a pre-set threshold; it is the number of counts above 55 dBm0 during a five minute interval, under fully loaded busy hour PBX traffic conditions.

Table 10
Impulse Noise

Time	Level	Counts
5 Minutes	>55 dBmO	0

Variation of gain versus level

The variation of gain versus level (tracking error) measures how closely changes in input levels causes corresponding changes in output levels.

The tracking error is measured in decibels and is defined as the deviation in gain or loss through a range of input level relative to the gain or loss at the reference frequency and level of 0 dBmO.

There are two methods of measuring the tracking error.

Method 1

When a noise signal as defined in CCITT recommendation 0.131 is applied at the input of any interface, the gain versus level deviation at the output meets the limits set out in [Table 11](#).

Table 11
Variation of gain versus level method 1

Input Level dBm0	Gain Variation dB
-55 to -10	+/-0.5

Alternatively, when a sine wave input in the frequency range 700 - 1100 Hz is applied at the input of any interface, the gain vs level deviation at the output meets the limits given in [Table 12](#).

Reference frequency:

- 700 - 1100 Hz
- 1024 Hz

Table 12
Variation of gain versus level method 1

Input Level dBm0	Gain Variation dB
-10 to +3	+/-0.5

Method 2

With a sine wave in the frequency range of 700-1100 Hz applied to the input port of any interface, the variation of the gain versus level at the output port meets the limits given in [Table 13](#).

Reference frequency:

- 700-1100 Hz
- 1024 Hz

Table 13

Variation of gain versus level method 2

Input Level dBm0	Gain Variation dB
-37 to -50	+/-1
0 to 37	+/-0.5

Total distortion including quantization distortion

The quantization distortion is the difference between the original analog signal and the analog signal (signal plus noise) resulting from the decoding process. There are two methods of measuring the quantization distortion:

Method 1

With a noise signal corresponding to CCITT recommendation 0.131 applied to the input interface, the total distortion measured at the output interface lies above the limit given in [Table 14](#).

Table 14
Total distortion method 1

Input Signal dBmO	Analog — Analog dB	Digital — Analog dB
-55	11.1	13.1
-40	26.1	28.1
-34	30.7	32.7
-27 to -6	32.4	34.4
-3	24.0	26.8

Method 2

With a sine wave at the reference frequency is applied to the input interface, the total distortion measured at the output port interface lies above the limit given in [Table 15](#).

Reference frequency:

- 1020 Hz

Table 15
Total distortion method 2

Input signal dBm0	Analog — Analog dB	Digital — Analog dB
-45	22	24
-40	27	29
-30 to 0	33	35

Spurious in-band signal

When a sine wave signal in the range of 700-1100 Hz, at a level of 0 dBmO is applied to the input port, the output level (at any frequency other than that of the applied signal,) is less than -40 dBmO when measured selectively in the band 300-3400 Hz.

Spurious out-of-band signal

When a sine wave signal in the range of 300-3400 Hz, at a level of 0 dBmO is applied to the input port, the level of spurious out-of-band image signals measured selectively at the output port is lower than -25 dBmO.

Discrimination against out-of-band signals

With any sine wave signal above 4.6 kHz applied to the input port at -25 dBm0, the level of any image frequency produced at the output is at least 25 dB below the level of the test signal.

Intermodulation

When two sine wave signals, f1 and f2, in the range of 450 to 2050 Hz, not harmonically related and of equal level in the range -21 to -4 dBmO are applied to the input, they do not create any 2f2-f1 intermodulation product greater than 35 dB below the power level of the input signal.

Group Delay

Absolute group delay

The absolute group delay is the minimum group delay measured in the frequency band 500-2800 Hz. The absolute group delay meets the limits given in [Table 16](#).

Table 16
Absolute group delay

Interface type	Absolute Group Delay Microseconds
Analog — Analog	3000
Analog — Digital	2700
Digital — Digital	2400

Group delay distortion

The group delay distortion is the difference between the absolute group delay (minimum delay) and the group delay in the range 500 to 2800 Hz.

Table 17
Group delay distortion

Frequency range	Group delay distortion Microseconds
500-600	1800
600-1000	900
1000-2600	300
2600-2800	1500

Longitudinal balance

Longitudinal balance defines the amount of impedance balance that exists between the tip and ring conductor with respect to ground. Longitudinal balance is measured by injecting a longitudinal signal on the tip and ring conductors with respect to ground and measuring the amount of signal (noise) that is introduced between the tip and ring. The equation for calculating longitudinal balance is:

Longitudinal Balance = 20 Log Vs/Vm

Vs is the disturbing longitudinal voltage and Vm is the tip to ring metallic noise voltage. Ideally the metallic noise voltage would be negligible and the longitudinal balance would approach infinity.

Table 18
Longitudinal balance for loop start interfaces

Frequency Hz	Minimum balance dB	Average balance dB
200	58	63
500	58	63
1000	58	63
3000	53	58

Crosstalk

Crosstalk is speech signal (signalling) energy transferred from one voice channel to another. The crosstalk coupling loss for every possible type of connections over the frequency range of 200 to 3200 Hz is shown in [Table 19](#).

Test Source:

Frequency 200-3200 Hz 0 dBmO.

Table 19
Crosstalk

	Minimum Attenuation	Design Objective
Connection type	dBm0	dBm0
Line — Line	>65	>75
Line — Trunk	>65	>75
Trunk — Trunk	>65	>75

Chapter 3 — Spares planning

Introduction

Spares planning is used to determine desired inventory levels of spares (replaceable) items. Spares planning is used by repair houses and centralized depots in order to ensure that there is an adequate stock of replaceable items on hand.

This section will provide the information necessary to calculate spares for the Meridian 1 Option 11C Compact system.

Definitions and assumptions

Failure rate: Spares planning is based on the Failure rate of the replaceable part. The failure rate is defined as the estimated number of failures for that item during one million (10^6) hours of operation.

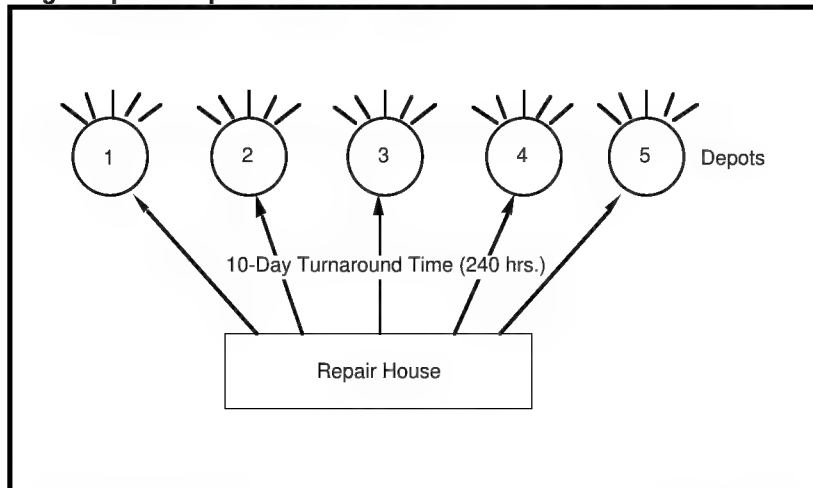
Sparing interval: the sparing interval is the period of time that the stock of items should last without being replenished. This period is assumed to be one year after the installation of the system.

Stock confidence level: the stock confidence level is the allowed probability of not going out of stock during the sparing interval. This is assumed to be greater than 99.9 percent.

Turnaround time for repair: the turnaround time for repair is the length of time it takes to repair a failed spares item.

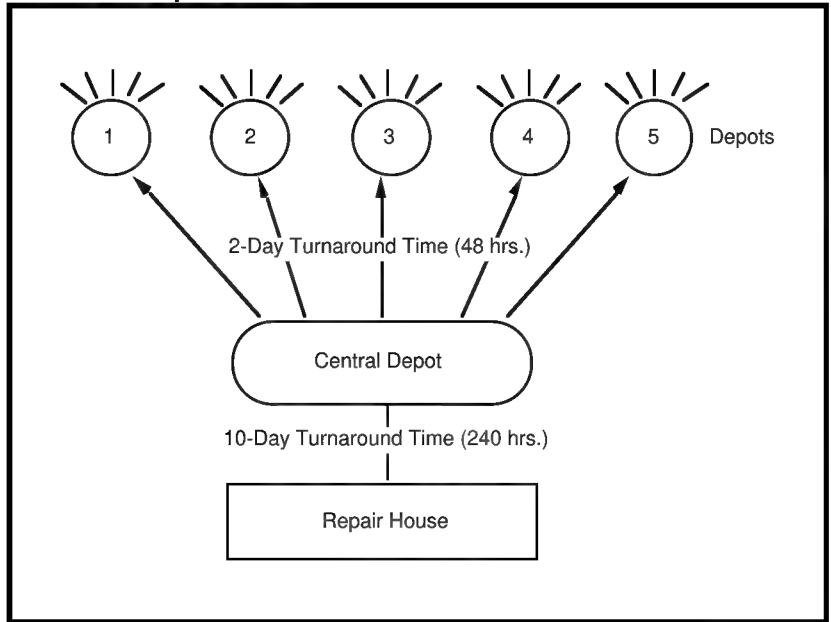
The turnaround time from a repair house is estimated to be 10 working days (240 hours). (See [Figure 3](#)).

Figure 3
Single depot or repair house service



The turnaround time from a centralized depot is estimated to be 2 working days (48 hours). (See [Figure 4](#)).

Figure 4
Centralized depot service



Actual turnaround periods will vary in the field.

Population range: the population range is the quantity of Meridian 1 Option 11C Compact systems in the area served by the depot.

Spare stock size: the spare stock size for a given item depends on the sparing interval, stock confidence level, failure rate, turnaround time for repair, and population range.

Calculating spares requirements

The quantity of a replaceable item that is required to stock a depot for one year can be calculated using a formula:

$$N \times F \times T$$

The spares planning formula has the following components:

N — The number of a spares item in use.

F — The failure rate of a particular spares item.

T — The turnaround time for repairing a failed spares item in hours.

The formula produces an NFT value. The number of spares required for a one year period may be found by looking up the NFT value in [Table 21, “Number of spares required,” on page 37](#).

[Procedure 1](#) provides an example of spares planning for the NTMW07 card.

Procedure 1

Determining spares quantities for a one year sparing interval

- 1 Determine the number (N) of the particular item that is being serviced by the depot.

For example, a single depot services 10,000 Universal Trunk Cards.

- 2 Determine the failure rate (F) for the specified item.

From the Failure rates listed in [Table 20](#), the failure rate for the Universal Trunk Card is [0.44](#).

- 3 Determine the turnaround time (T) in hours.

Assume a centralized depot with a turnaround time of 48 hours.

- 4 Calculate the NFT value by multiplying $N \times F \times T$.

$$\text{NFT} = (10,000 \text{ units} \times 0.44 \times 48 \text{ hours}) / 1,000,000 = 0.21$$

From the NFT values in [Table 21](#), the number of spares required for NFT value 0.21 = 4.

Therefore, four NTMW07 cards are needed to last an interval of one year when servicing 10, 000 NTMW07 cards.

End of Procedure

Failure rates

The failure rates in [Table 20](#) are for the Option 11C Compact system components.

Note: Rates for circuit cards are based on 40°C ambient temperature.

Table 20
Failure rates for system components

NT code	Description	Failure rate per 10 ⁶ hrs.
	Circuit cards:	
NTMW01	Small System Controller card	1.67
NTMW02	Mail CPU	1.41
NTMW03	4-Port Mail Daughterboard	0.69
NTMW04	DTI/PRI card	0.80
NTMW05	Digital Line Card	0.72
NTMW06	Analog Line Card	1.48
NTMW07	Line/Trunk Card	0.44
NTMW10	10 m Receiver card	1.21
NTMW11	Power supply	0.94
NTMW12	Analog Line daughterboard	0.48
NTDK21	Software Daughterboard	0.63
NTDK22	10 m Fiber Daughterboard	1.21
—Continued—		

NT code	Description	Failure rate per 10 ⁶ hrs.
	Telephone sets:	
NTZK06	M2006 telephone	3.08
NTZK08	M2008 telephone	3.10
NTZK16	M2616 telephone	3.88
NTZK22	M2216ACD-1 telephone	4.68
NTZK23	M2216ACD-2 telephone	5.37
NT6G00	M2250 TCM Console	N/A
- End -		

NFT values

Table 21 translates NFT values to the number of spares required in stock:

N—Number in use

F—Failure rate

T—Turnaround time (in hours)

Table 21
Number of spares required

NFT values		Number of spares
0	0.0010	1
0.0010	0.0452	2
0.0452	0.1890	3
0.189	0.425	4
0.425	0.734	5
0.734	1.090	6
1.09	1.50	7
1.50	1.95	8
1.95	2.43	9
2.43	2.94	10
2.94	3.46	11
3.46	4.01	12
4.01	4.58	13
4.58	5.16	14
5.16	5.76	15
5.76	6.37	16
—Continued—		

NFT values		Number of spares
6.37	6.99	17
6.99	7.62	18
7.62	8.26	19
8.26	8.91	20
8.91	9.57	21
9.57	10.20	22
10.2	10.90	23
10.9	11.50	24
11.5	12.20	25
12.2	12.90	26
12.9	13.60	27
13.6	14.30	28
14.3	15.00	29
15.0	15.80	30
- End -		

Chapter 4 — Power supplies

Introduction

This chapter describes the Meridian 1 Option 11C Compact NTMW11AC Power Supply unit and the operation of the Power Fail Transfer Unit (PFTU).

Features

Dimensions and weight

The NTMW11 Power Supply measure approximately 12.5 in. (305 mm) high, 5 in. (127 mm) wide and 10 in. (245 mm) deep, and weighs approximately 12 lb (5.5 kg).

Power Supply features

The NTMW11 Power Supply has the following features:

- A current limiting circuit which limits the surge of current on the input line when the system is first switched on.
- Generation of a system line transfer signal.
- Differential mode and common mode EMI filtering of input.

Voltage

The NTMW11 Power Supply provides +5.1, +8.5, +15, -15V, -150V, -52V and filtered -48V.

There is a 1.0 second start-up delay on the +5V rail.

Ringling Generator

The NTMW11 Power Supply provides the following ringling generator for telephones:

- Ringling voltage: 70, 75, 80, 86V.
- Ringling frequency: 20, 25, 50 Hz, switch selectable.
- Ring sync: A pulse 500 us wide, 6 or 11 ms (± 3 ms) before the positive going zero crossing of the ringling waveform (11 ms for 20/25 Hz).
- Power: The output capability is 8VA which is capable of ringling 8CA4 ringers.

Power supply LED

The LED on the power supply faceplate is extinguished when there is a problem with the power supply.

Under-voltage

Under-voltage to the NTMW11 Power Supply results in partial failure of the Option 11C Compact system. The faceplate LED extinguishes.

WARNING

Under-voltage, in the case of +5.1V, results in the complete shutdown of the system.

[Table 22](#) outlines the nominal and under-voltage limits of the NTMW11 Power Supply.

Table 22
Nominal and under-voltage limits

Nominal	Under-voltage limit	Power supply status
+5.1V	+3.8V	Complete Shutdown
8.5V	+6.4V	Partial failure
-150V	-100.0V	Partial failure
+15V	+11.2V	Partial failure
-15V	-11.2V	Partial failure
-48V	-36.0V	Partial failure
Ring (Pk V)	70V	Partial failure
-52V	-45V	Partial failure

Overvoltage

An OVP (Over-Voltage Protection) circuit shuts down the power supply when the output voltage exceeds the limits given in [Table 23](#).

Table 23
Nominal and overvoltage limits

Nominal voltage	Overvoltage limit	Power supply status
+5.1V	+6.4V	Complete Shutdown
+8.5V	+10.6V	Complete Shutdown
-150V	-187.5V	Complete Shutdown
+15V	+18.7V	Complete Shutdown
-15V	-18.7V	Complete Shutdown
-48V	N/A	N/A
Ring (Pk V)	150V	Complete Shutdown
-52V	-58V	Complete Shutdown

All outputs in a shutdown state are reset by the SSC card.

Note: The system power does not automatically reset when there is overvoltage on the -52V DC output. Manual reset is required. The manual reset button is located on the faceplate of the SSC card.

Temperature sensor

The NTMW11 Power Supply is sensitive to the temperature of the cabinet and the system power. A thermostat is located at the top of the power supply unit. The input breaker trips for temperatures exceeding 175°F (80°C).

Power Fail Transfer (PFT) operation

The NTMW07 Line/Trunk card has a built-in Power Failure Transfer (PFT) feature, designed to operate with a loop start trunk. This feature allows the connecting one trunk on the card to an analog telephone on the same card in the event of a commercial power or system failure.

Note: Ground start trunks require a telephone set equipped with a ground start button to place outgoing calls when in PFT mode.

Power Fail Transfer (PFT) mode occurs under any of the following conditions:

- The SSC card sends a signal to activate PFT
- A power failure occurs
- A CPU failure occurs
- The fiber link to an expansion cabinet fails (PFT for that cabinet only)

The Terminal Numbers (TNs) that are equipped to perform the PFT function vary depending on the slot assignment in the cabinets. When a PFT occurs, the following are connected:

- **In the Main cabinet**
 - When the NTMW07 card is in slot 1 & 2
TN 01 03 connects to TN 02 03
(Trunk on Card 01 Unit 03 connects to the telephone on Card 02 Unit 03)
 - When the NTMW07 card is in slot 3 & 4
TN 03 03 connects to TN 04 03
(Trunk on Card 03 Unit 03 connects to the telephone on Card 04 Unit 03)
 - When the NTMW07 card is in slot 5 & 6
TN 05 03 connects to TN 06 03
(Trunk on Card 05 Unit 03 connects to the telephone on Card 06 Unit 03)

- **In the Expansion cabinet**
 - When the NTMW07 card is in slot 11 & 12
TN 11 03 connects to TN 12 03
(Trunk on Card 11 Unit 03 connects to the telephone on Card 12 Unit 03)
 - When the NTMW07 card is in slot 13 & 14
TN 13 03 connects to TN 14 03
(Trunk on Card 13 Unit 03 connects to the telephone on Card 14 Unit 03)
 - When the NTMW07 card is in slot 15 & 16
TN 15 03 connects to TN 16 03
(Trunk on Card 15 Unit 03 connects to the telephone on Card 16 Unit 03)

Commercial Power Backup

An Un-interruptible Power Supply (UPS) may be connected to the Option 11C Compact system in order to provide a continuous supply of AC-power.

The UPS requirements are based on the following:

- The NTMW11 Power Supply is rated at 750 VA Maximum
- The Real Power is 460 W Maximum
- The Power Factor is approximately 0.6
- The power-up in-rush surge current is 35A maximum (120 VAC)

A typical 80-line single cabinet system (CPU, Voice Mail, three 24 DLC, one PRI) will have a UPS load of approximately 360 VA.

Selecting a UPS is a function of the total power to be supplied multiplied by the total hold-up time desired.

Chapter 5 — NTMW01 Small System Controller

Introduction

This chapter describes the NTMW01 Small System Controller (SSC) card used exclusively with Meridian 1 Option 11C Compact systems.

NTMW01 Small System Controller card

The NTMW01 Small System Controller (SSC) card controls call processing, stores system and customer data, and provides an expansion interface. The NTMW01 SSC card is comprised of the following components and features:

- Flash daughterboard memory, DRAM and Backup memory
- A fiber-expansion daughterboard interface
- One PCMCIA socket
- Three Serial Data Interface (SDI) ports
- 32 channels of Conferencing
- One Ethernet (10 Mbps interface) port
- 30 channels of tone and digit switch (TDS) and up to 16 Digitone receivers (DTR)
- Networking and Peripheral Signalling

Memory

The majority of system and customer configured data is both controlled and stored on the NTMW01 SSC card's Flash ROM. An active and backup copy of customer data is also kept on the Flash ROM.

Additional memory, referred to as DRAM on the NTMW01 SSC card, temporary stores and processes automated routines and user-programmed commands. The NTMW01 SSC card also retains a copy of customer files in the event of data loss, in an area called the Backup flash drive.

The NTMW01 SSC card's Flash daughterboard performs the significant portion of system software storage and data processing for the Meridian 1 Option 11C Compact. The 32 Mbyte daughterboard is comprised of Flash ROM and Primary Flash drive.

The Flash ROM holds 24 Mbytes of ROM memory, comprising operating system data and overlay programs. Flash ROM is expandable using an expansion flash daughterboard.

The Primary Flash drive contains 8 Mbytes of storage space. Most of the data storage is allocated to the Primary Flash drive - the main storage area of customer configured data.

Other system data such as the Secure Storage Area (SSA) also resides in the Flash drive. The SSA holds data that must survive power-downs.

Boot ROM is a 2 Mbyte storage device located on the NTMW01 SSC card's motherboard. It is comprised of boot code, system data, patch data and the backup copy of the Primary Flash drive's customer database.

The NTMW01 SSC card is equipped with 8 Mbytes of temporary memory space called DRAM. DRAM functions much like RAM on a computer system, whereby system and user files are stored while the system is up and running. DRAM on the Meridian 1 Option 11C Compact system stores operating system files, overlay data, patch codes, and the active copy of the customer database.

Fiber Expansion daughter board

An NTDK22 Fiber Expansion Daughter Board mounted on the NTMW01 SSC card allows the installation of an expansion cabinet up 33 ft (10 m) from the main cabinet. An A0632902 Fiber Optic (multi-mode) plastic cable is used to connect the cabinets together.

The daughter board also provides an additional 16-channel conference loop and one SDI port at the expansion cabinet.

Fiber Receiver card.

An NTMW10 Fiber Receiver card installed in the expansion cabinet is used to connect to the A0632902 Fiber Optic cable from the main cabinet.

PCMCIA interface

The NTMW01 SSC card has a PCMCIA interface through a socket located on its faceplate. The PCMCIA socket can accommodate a Software Delivery card used as backup media.

SDI ports

The NTMW01 SSC card contains three SDI ports used to connect on-site terminals or remote terminals through a modem. The default settings on the ports are as follows:

TTY Port	Baud rate	Data bits	Stop bits	Parity	Use
0	Set by a DIP switch	8	1	None	MTC/SCH/BUG
1	1200	8	1	None	MTC/SCH/BUG
2	1200	8	1	None	MTC/SCH/BUG

Refer to "Chapter 6 —SDI ports" on page 49 of this guide for more information on the SDI ports.

Conferencing

Thirty two conference channels are provided by the NTMW01 SSC card's conference devices. Conference capability can be increased by 16 channels by mounting an NDK22 Expansion daughterboard on the NTMW01 SSC card: the maximum number of conference ports is 48.

A conference call can have three to six participants. To illustrate, you can have a maximum of five 3-party conferences per device, or two 6-party conferences plus one 3-party conference. It is not possible to conference between conference devices.

Ethernet Interface

The NTMW01 SSC card is equipped with a 10 Mbps Ethernet port. External connections to the ethernet port is provided by a 15-pin connector located in the main cabinet. This is a standard 15-pin AUI interface for a MAU.

Chapter 6 — SDI ports

Introduction

This chapter describes the SDI ports on the Meridian 1 Option 11C Compact system. Serial Data Interface (SDI) ports are used to connect devices such as terminals and modems to the Option 11C Compact. The two types of SDI ports supported are:

- Data Terminal Equipment (DTE); typically a TTY or computer and
- Data Communication Equipment (DCE); typically a modem

Note: Both DTE and DCE ports adhere to either RS232 or RS422 communication standards.

SDI ports are found on the NTMW01 SSC card with an additional port located on the Fiber Receiver card in the expansion cabinet.

Small System Controller (SSC) card

The NTMW01 SSC card is equipped with three SDI ports.

Each port can be used to connect a modem or terminal to the system. If connection to a terminal is required, an A0378652 NO modem (NULL modem without hardware handshaking) is needed.

The SDI port connector is located at the bottom rear of the cabinet (An NTBK48 three-port cable is required to connect to system equipment.)

The Baud rate for port 0 is selected by setting switches on the faceplate of the NTMW01 System Core card. Baud rates for ports 1 and 2 are set using overlay programs.

The baud rates available on all three ports are 300, 600, 1200, 2400, 4800, 9600 and 19200 baud. Table [24](#) shows the default settings.

Table 24
Default port configuration

TTY Number	Card	Port	Use	Configuration
0	0	0	MTC/SCH/BUG	1200/8/1/NONE
1	0	1	MTC/SCH/BUG	1200/8/1/NONE
2	0	2	CTY	1200/8/1/NONE

NTMW10 Fiber Receiver card

The NTMW01 Fiber Receiver card located in the expansion cabinet supports one Serial Data Interface (SDI) port.

Parameter settings

Baud rates are selected by setting switches located in the faceplate the Fiber Receiver card. The available settings are:

- 150, 300, 600, 1200, 2400, 4800, 9600 and 19200 baud

Other RS232 parameters are fixed as shown in Table [25](#).

Table 25
Fixed parameter settings

Parameter	Setting
Parity	None
Mode	Asynchronous
Stop Bits	1
Data Bits	8

The port can be used for MTC/SCH/BUG modes.

Connection to external equipment

The connection to external devices (such as TTYs, Modems and so on) is achieved through the nine-pin SDI connector located in the expansion cabinet. It is extended to the external equipment with an NTAK1118 single port SDI cable.

Chapter 7 — Meridian Modular Telephones

Functional description

The Meridian Modular Telephones are designed to provide cost effective integrated voice and data communication capability. They interface with Meridian 1 Option 11C Compact using the Digital Line Card (DLC). No additional hardware is required at the line circuit to provide data communication.

Meridian Modular Telephones are connected to the system through a two-wire loop carrying two independent 64 Kb/s PCM Channels with associated signaling channels. One of the two PCM channels is dedicated to voice while the other is dedicated to data traffic. Line cords and handset cords on all Meridian Digital Telephones are equipped with snap-in TELADAPT connectors for easy and quick connecting procedures.

Peripheral equipment requirements

The telephone interfaces with the NTMW05 Digital Line Card (DLC) in Meridian 1 Option 11C Compact. The digital line card supports 24 voice ports (units 0 through 23) and eight Integrated Data ports (units 24 through 31, associated with voice units 8 through 15), each of which supports one data and one voice channel. A voice TN and a data TN are assigned in the software.

General description

This chapter describes the various features and capabilities of the following Meridian Modular Telephones.

M2006—a single line telephone with 6 programmable function keys. See [Figure 5](#) on [page 55](#).

M2008—a multi-line telephone with 8 programmable function keys. See [Figure 6](#) on [page 56](#).

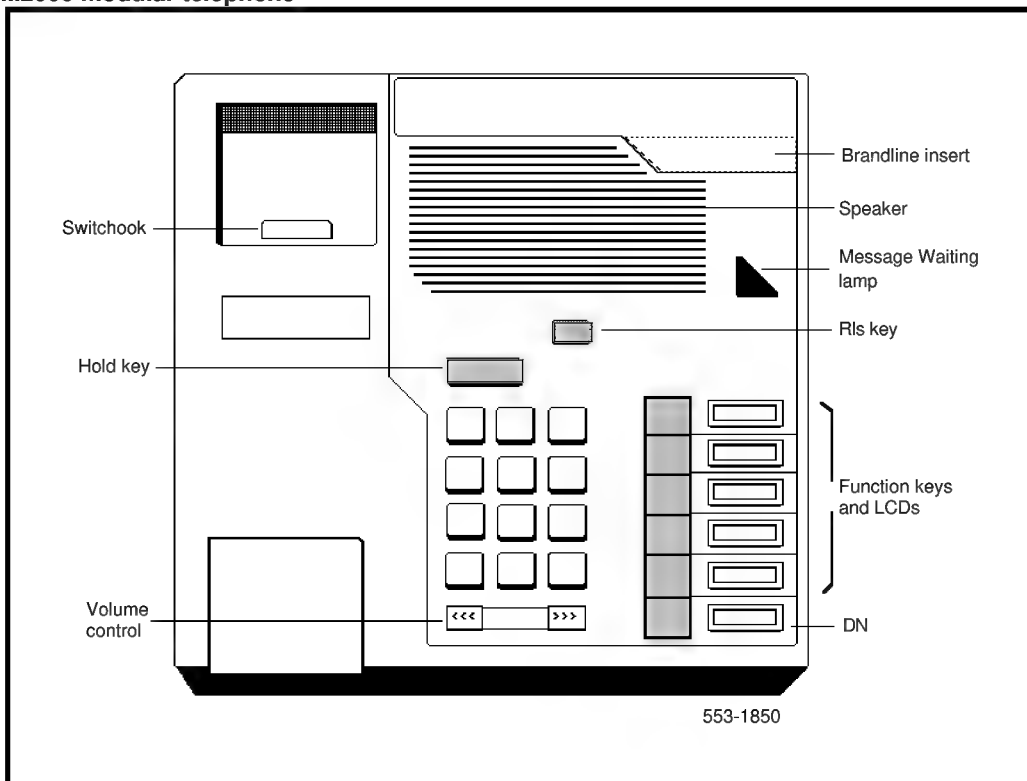
M2616—a high performance multi-line telephone with 16 programmable function keys and integrated Handsfree unit. See [Figure 7](#) on [page 57](#).

M2016S—a Telephone Security Group Class II approved telephone designed to provide on-hook security. It is similar to the M2616, with 16 programmable function keys, but has no handsfree capability. See [Figure 7](#) on [page 57](#).

M2216ACD-1—a multi-line telephone for ACD operations. It has 15 programmable function keys, a special ACD Display Module and two RJ-32 jacks for modular electret headsets. See [Figure 8](#) on [page 58](#).

M2216ACD-2—a multi-line telephone for ACD operations. It has 15 programmable function keys, and a special ACD Display. It is similar to model 1, but with one PJ-327 jack for a carbon agent headset and one RJ-32 jack for an electret supervisor headset. See [Figure 8](#) on [page 58](#).

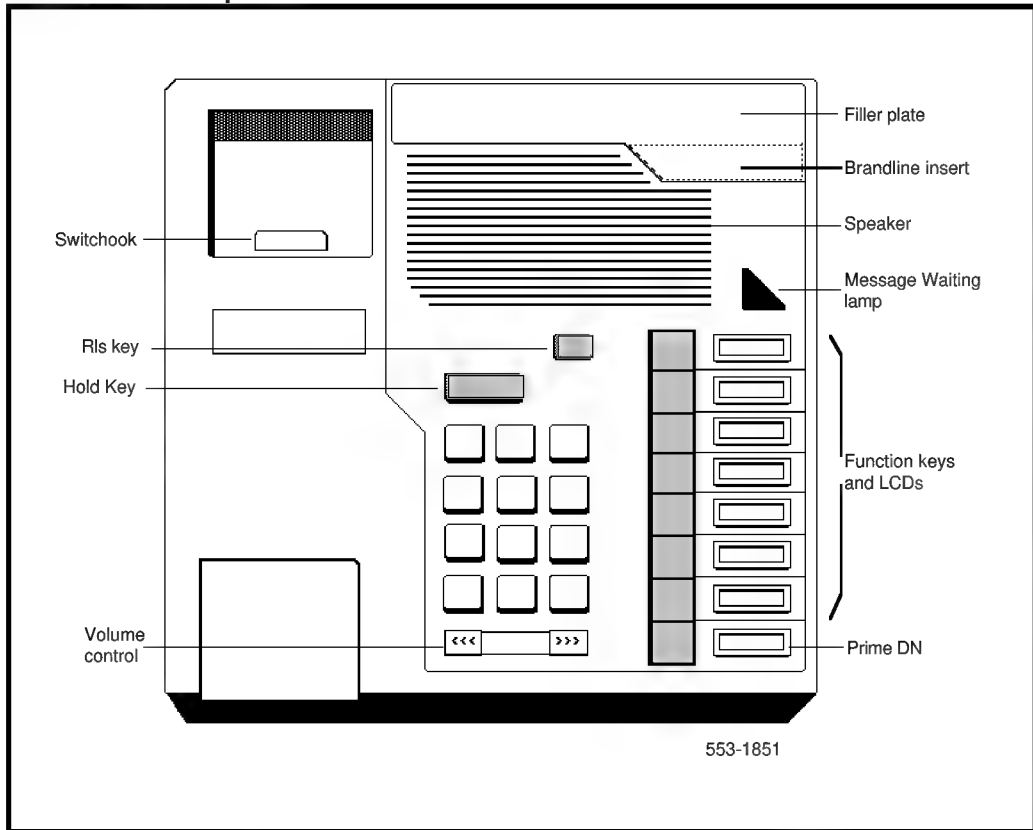
Figure 5
M2006 modular telephone



Dimensions:

- Length: 8.42 in. (215 mm)
- Width: 8.42 in. (215 mm)
- Height: 3.61 in. (93mm)
- Weight: approximately 2 lb (1 kg)

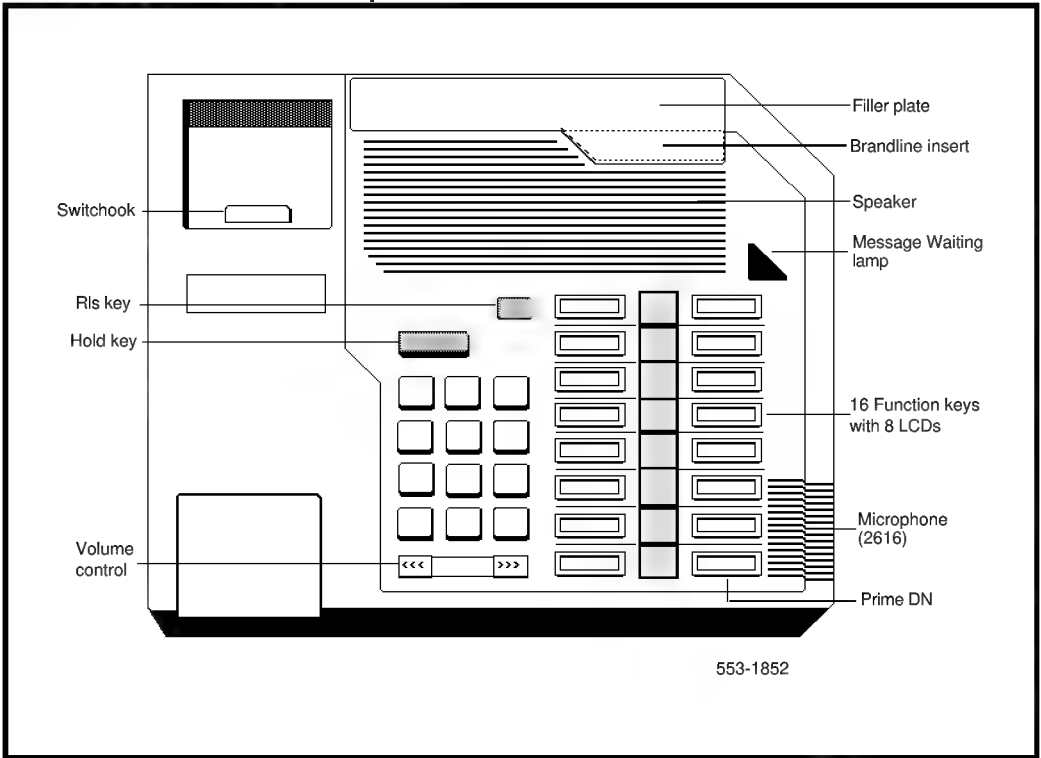
Figure 6
M2008 modular telephone



Dimensions:

- Length: 8.42 in. (215 mm)
- Width: 8.42 in. (215 mm)
- Height: 3.61 in. (93 mm)
- Weight: approximately 2 lb (1 kg)

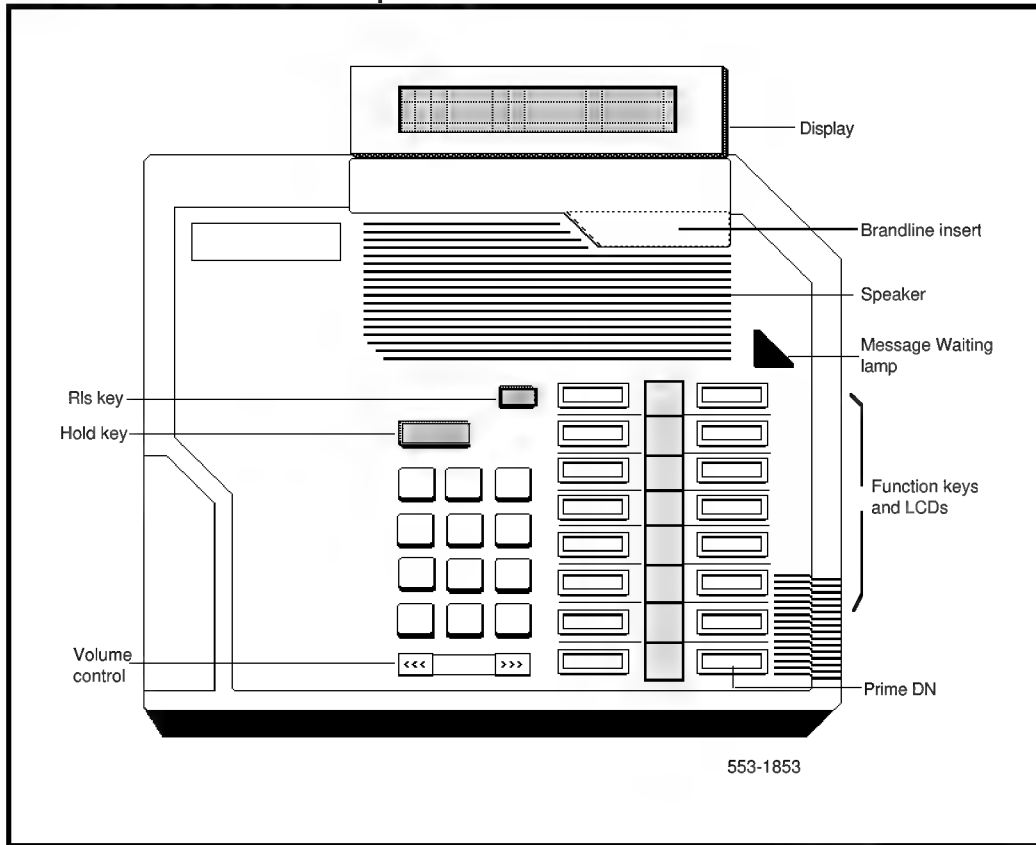
Figure 7
M2016S and M2616 modular telephones



Dimensions:

- Length: 9.75 in. (250 mm)
- Width: 9.45 in. (235 mm)
- Height: 3.64 in. (93 mm)
- Weight: approximately 2 lb (1 kg)

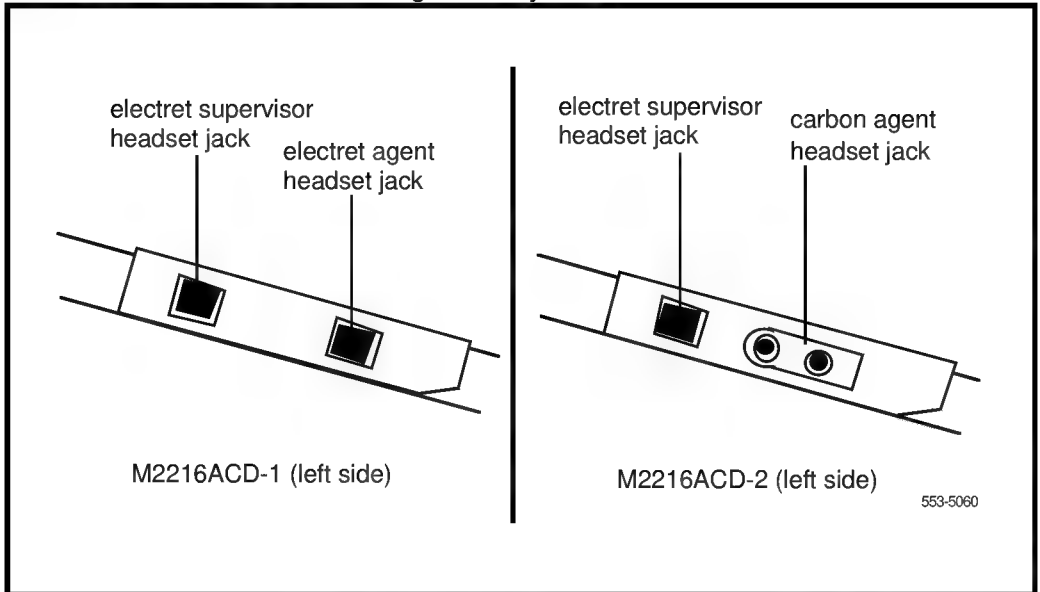
Figure 8
M2216ACD-1 and -2 modular telephones



Dimensions:

- Length: 9.75 in. (250 mm)
- Width: 9.45 in. (235 mm)
- Height: 3.64 in. (93 mm)
- Weight: approximately 2 lb (1 kg)

Figure 9
M2216ACD-1 and -2 left side showing headset jacks



Physical characteristics

All of the Meridian Modular Telephones are equipped with:

- Hold key
- Release key
- Volume control
- Message Waiting lamp
- Speaker

Each modular telephone also has a number of programmable keys with LCD indicators that can be assigned to any combination of directory numbers and features (only one DN for the M2006). The lower right-hand key (key 0) is reserved for the Primary DN.

When equipped with a Display module or MPDA, key 07 is automatically assigned as the Program key and cannot be changed. Key 05 becomes the Program key on the M2006, if equipped with MPDA.

The M2006 is a single line telephone and accepts only one DN. The remaining five key/lamp pairs can be assigned any feature that is not considered a DN, such as Transfer, Call Forward, or Conference. Features that cannot be assigned are those that are considered DNs: Voice Call and 2-way Hotline, for example. Attempting to assign more than one DN to the M2006 causes the telephone to disables itself and all LCDs light steadily. It will return to its normal operating state when service change removes all secondary DNs.

LCD indicators support 4 key/LCD states:

Function	LCD state
idle	off
active	on (steady)
ringing	flash (60 Hz)
hold (or feature pending *)	fast flash (120Hz)

* An indicator fast flashes when you have pressed a feature key but have not completed the procedure necessary to activate the feature.

Volume control

One key with two toggle positions controls volume. Pressing the right “volume up” or left “volume down” side of the key incrementally increases or decreases the volume for the tone or sound which is currently active. The volume settings are retained for subsequent calls until new volume adjustments are made. If the telephone is equipped with a Display Module, volume can be adjusted at any time with the setting displayed on the screen (in Program mode).

Handset volumes can be configured to return to nominal on a per call basis.

You can adjust the volume of the following tones, while they are audible:

- ringing
- handsfree (M2616)
- handset/headset

- buzz
- on-hook dialing

When the telephone is disconnected, all volume levels will return to default values upon reconnection.

When the telephone is operating on loop power alone, the highest (eighth) step in volume cannot be reached (as seen when using Display in Program mode).

Message Waiting lamp

Each Meridian Modular Telephone has a red triangle in the upper right-hand corner that lights brightly to indicate a message is waiting. This LED is the primary message waiting indicator and lets you know a message is waiting regardless of whether the telephone has a message waiting key/lamp pair. You must have Message Waiting CCOS configured.

If you do assign a message waiting key/lamp pair, there will be two indications of a message waiting:

- the red Message Waiting triangle lights, and
- the LCD associated with the Message Waiting key flashes.

You may assign an Autodial key that dials the message center (or voice mail system) to avoid the double indication, or have no key/lamp pair assigned to the message center.

The Message Waiting lamp is also used to indicate security of the M2016S. The red LED triangle lights steadily when the phone is not secure (handset is off-hook, phone is ringing or any time the handset/piezo relays are connected). The red LED triangle blinks when a message is waiting.

Handsfree (M2616 only)

Handsfree (if software assigned), allows the user to talk to another party without lifting the handset. Activate Handsfree by depressing the Handsfree/mute key (key 15, top left) or by selecting a DN without lifting the handset. Once Handsfree is activated, it can be deactivated by picking up the handset or by ending the call using the Release (RLs) key. If Handsfree is not software assigned, you can assign any other feature to key 15.

When the Handsfree/mute key is pressed during a Handsfree call, the microphone is deactivated while the speaker remains active, preventing the other party from overhearing local conversations. The Handsfree LCD indicator flashes while the microphone is muted. Pressing the Handsfree/mute key again reactivates the microphone and the Handsfree LCD lights steadily.

Features and options matrix

[Table 26](#) lists the distinctive characteristics of each Meridian Modular Telephone and shows the optional hardware that you can add to each.

Table 26
Hardware features and options

	M2006	M2008	M2016S	M2616	M2216ACD-1	M2216ACD-2
Programmable keys	6	8	16	16	16	16
Handsfree microphone				standard		
Optional hardware available:						
Display		x	x	x	standard	standard
Key Expansion Module			x	x	x	x
Programmable Data Adapter	x	x	x	x	x	x
External alerter interface	x	x		x	x	x
Brandline insert	x	x	x	x	x	x
Note: In this table, x indicates available features for the set type listed along the top row.						

Note: If the set is equipped with a Display or Meridian Programmable Data Adapter, the number of programmable keys is reduced by one, as key 07 (key 05 on M2006) automatically becomes the Program key.

Optional equipment

The modular design of the digital telephones described in this document makes adding hardware options easy (see [Figure 10 on page 66](#)). Below is a list of hardware you can add to Meridian Modular Telephones.

Display Module

A two line by 24 character Display Module provides system prompts, feedback on active features and valuable calling party information. In addition, you can modify various set features such as volume and screen contrast using the Program key (top right function key). You can enable a Call Timer which times calls made or received on the prime DN.

The Display Module requires a Power Supply Board on M2008 (see [“Power requirements” on page 70](#)).

There are two types of Display Module available:

- North American Display—supports normal business features in two languages, English and Quebec French.
- Special Applications Display—supports the following features:
 - Automatic Call Distribution (ACD)
 - six languages (English, Quebec French, Parisian French, German, Spanish, Dutch)

A Special Applications Display Module comes as standard equipment on the M2216ACD telephones. M2008 or M2616 telephones used as ACD telephones require the Special Applications Display.

Note: It is possible to adjust the Display screen contrast so that it is too light or too dark to read. If you cannot read the Display, disconnect and then reconnect the line cord to return to the default settings.

Meridian Programmable Data Adapter

The Meridian Programmable Data Adapter (MPDA) mounts within the telephone (see [Figure 11 on page 67](#)) and allows asynchronous ASCII terminals, personal computers and printers to be connected to the telephone using an RS-232-D (subminiature) interface. The MPDA has multilingual capability.

It requires additional power (see [“Power requirements” on page 70](#)).

For more information, see [“Meridian Programmable Data Adapter” on page 77](#).

Program key

The Program key is automatically assigned to Meridian Modular Telephones with Display or MPDA added. It allows you to change a variety of display features such as screen format, contrast and language. It also lets you change data parameters such as transmission speed and parity.

The upper right-hand key (key 05 on M2006, key 07 on all others) automatically becomes the Program key when Display or MPDA is configured with the telephone. The Program key is local to the set and shows blank when you print key assignments in LD20.

External Alerter Interface

The External Alerter Board provides an interface to standard remote ringing devices, such as a ringing unit installed in a location separate from the telephone. The External Alerter Interface is not the remote ringer itself, but provides access to standard, off-the-shelf remote ringing devices. The Alerter Board requires additional power (see [“Power requirements” on page 70](#)).

You can program the External Alerter Interface to activate a ringer (or light) when the telephone rings or when the telephone is in use (off-hook).

Key Expansion Module

A modular 22 key unit can be attached to any 16 key Meridian Modular Telephone. The extra keys can be assigned to any combination of lines and features. You can add up to two expansion modules to a single telephone. You will need a separate footstand for the module(s), one for a single module, one for a double. The expansion module requires additional power (see [“Power requirements” on page 70](#)).

The Key Expansion Module connects to the telephone through a ribbon cable running from the base of the telephone. It is physically connected to the telephone by the footstand.

Brandline Insert

The filler plate on the telephone or Display Module contains a removable insert designed to accommodate custom labeling. You can order blank Brandline Inserts and have a printer silk screen your company logo on them. Brandline Inserts snap easily into and out of the filler plate.

Headset

The M2216ACD telephones are compatible with three electret headsets:

- Plantronics Polaris
- GN Netcom Profile
- NT Liberation

The M2216ACD-2 agent jack is compatible with any standard carbon headset.

The headset interface of the M2216ACD-1 is adjustable to allow you to tune the electrical characteristics to optimize performance, while the M2216ACD-2 headset interface is fixed.

Any recording device connected to the receive path of a Meridian Modular Telephone must meet these requirements:

- load impedance at least 8K ohms across the audio band
- connect in parallel across pins 3 and 4 of the handset/headset jack
- isolate power source from the headset/handset jack

M2006/M2008/M2616

You can use an electret headset in the handset port of the M2006, M2008 or M2616 telephone. Choose an amplified headset that draws power from a battery or AC transformer (power is not provided by the telephone). The amplifier must draw less than 400 micro amps from the telephone jack.

The headset should be designed to work with a telephone jack with these characteristics:

Transmit interface: +5 V through 10K DC bias resistance with maximum current of 500 micro amps. The differential input impedance is 10K ohms. Connects to pins 2 and 5 of the handset jack.

Receive interface: single ended output with output impedance of 180 ohms. Connects to pins 3 and 4 of the handset jack.

Figure 10
M2616 with Display Module and Key Expansion Module

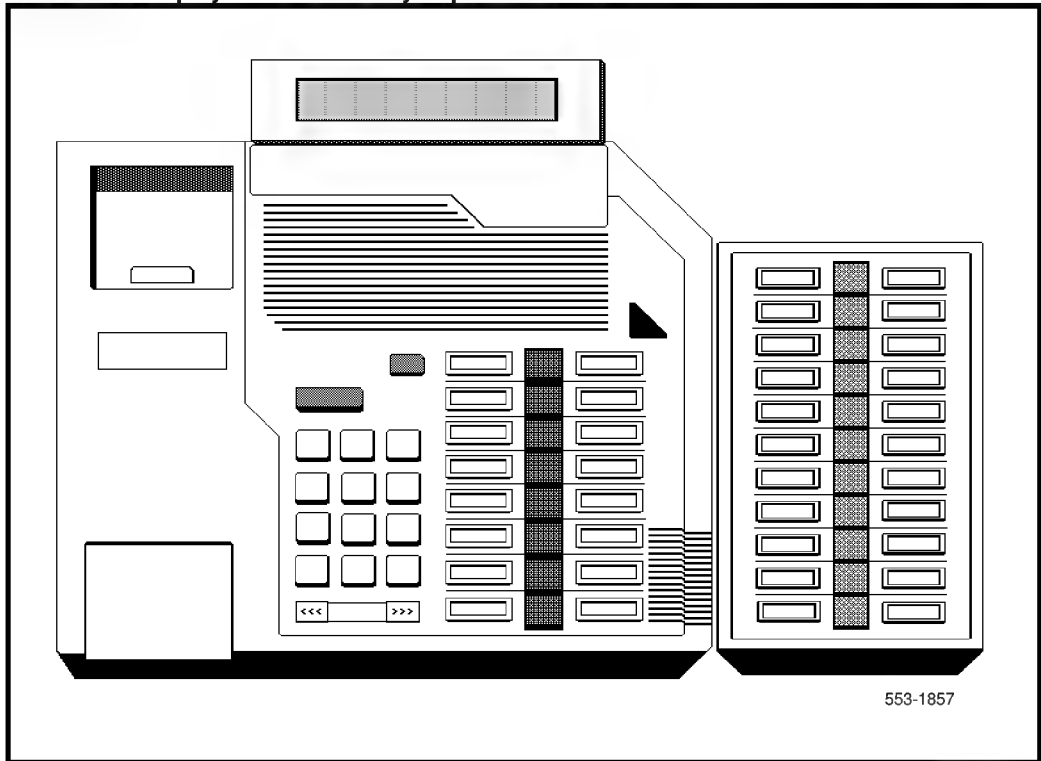
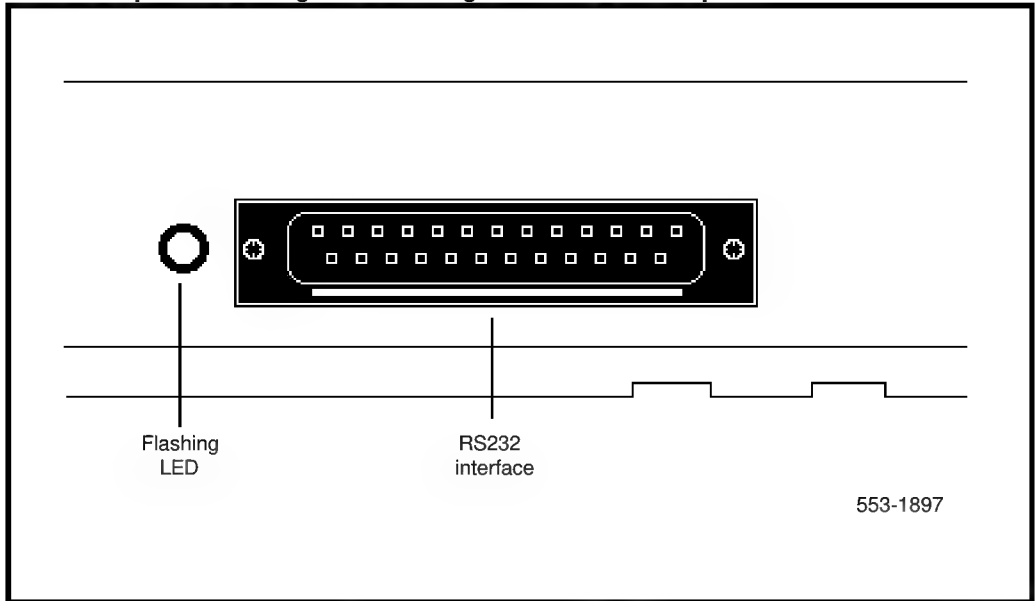


Figure 11**Back of telephone showing Meridian Programmable Data Adapter**

Specifications

The following specifications govern the performance of the Meridian Modular Telephones under the environmental conditions described.

Environmental and safety considerations

All digital telephones and their associated options meet the requirements of Electronic Industries Association (EIA) specification PN-1361.

Temperature and humidity

Operating state:

- Temperature range:
0° to 50° C (32° to 104° F)
- Relative humidity:
5% to 95% (non-condensing). At temperatures above 34°C (93°F) relative humidity is limited to 53 mbar of water vapor pressure.

Electromagnetic interference

The radiated and conducted electromagnetic interference meets the requirements of Subpart J of Part 15 of the FCC rules for class A computing devices.

Line engineering

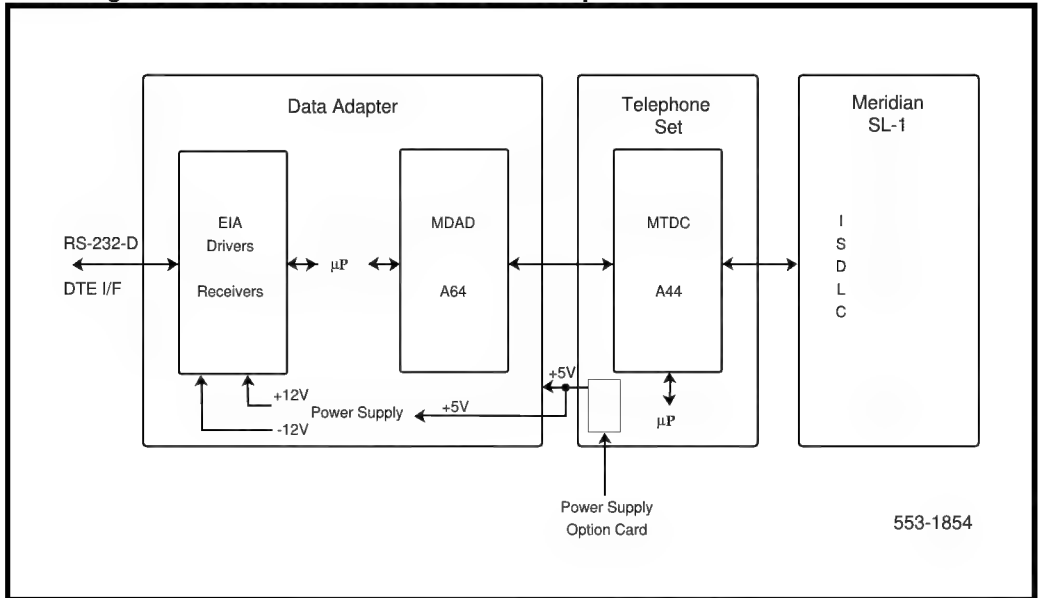
The maximum permissible loop length is 3500 ft. (915 m), assuming 24 AWG (0.5 mm) standard twisted wire with no bridge taps. A 15.5 dB loss at 256 KHz defines the loop length limit (longer lengths are possible, depending on the wire's gauge and insulation).

The Meridian Modular Telephones use a 6 conductor line cord (A0346862).

Note: Use only the line cord provided with the Meridian Modular Telephone. Using a cord designed for other digital telephones could result in damage to the cord.

Figure 12 shows a simplified block diagram of the Meridian Modular Telephone, MPDA and DLC in the Meridian 1 Option 11C Compact system.

Figure 12
Block diagram of MPDA and Meridian Modular Telephone



Local alerting tones

Each telephone provides four alerting tones and a buzz sound. The system controls the ringing cadence by sending tone-ON and tone-OFF messages to the telephone. The alerting tone cadences cannot be changed from the telephone, but can be altered for individual Meridian Modular Telephones by software controlled adjustments.

Alerting tone characteristics

The tone frequency combinations are given in [Table 27](#):

Table 27
Tone Characteristics

Tone	Frequencies	Warble Rate (Hz)
1	667 Hz, 500 Hz	10.4
2	667 Hz, 500 Hz	2.6
M2006 and M2008		
3	1600 Hz, 2000 Hz	10.4
4	1600 Hz, 2000 Hz	2.6
M2016S, M2616 and M2216ACD		
3	333 Hz, 250 H	10.4
4	333 Hz, 250 Hz	2.6

A 500 Hz buzz signal is provided for incoming call notification while the receiver is off-hook.

Power requirements

The M2006, M2008, M2616 (basic configuration and with Display Module) and M2216ACD-1 are loop powered. Loop power consists of a -30 V AC power source and assumes a 3500 ft. (915 m) maximum loop length of 24 AWG wire and a minimum 15.5 V AC at the telephone terminals.

Note: The loop length limit is defined by a 15.5 dB loss at 256 KHz.

The Handsfree feature, which is integrated into the M2616, requires no additional power.

Some configurations of telephones and options need more than basic loop power to operate. [Table 28](#) lists the Meridian Modular Telephones and shows when additional power is needed to operate the telephone or its optional hardware. Power Supply Boards come installed in factory-assembled configurations which require additional power.

If a power failure occurs, configurations which require loop power only continue to work if the Meridian 1 Option 11C Compact is equipped with a backup commercial power source such as an Uninterruptible Power Supply (UPS). Only those options which require additional power will cease to function.

During a power failure, the carbon agent headset on the M2216ACD-2 will fail and the electret supervisor's jack can be used as an agent jack. If no headset was plugged in to the electret jack at this time, the call is dropped, the agent logged off and must log in again once the electret headset is plugged in. When power is restored, the carbon jack returns automatically.

Table 28
Power requirements

Telephone type	Loop power	Additional power (Power Supply Board)
M2006	Basic configuration	Any option
M2008	Basic configuration	Any option
M2016S	No	All configurations
M2616	Basic configuration (with Handsfree) and Display	Programmable Data Adapter Key Expansion Module External alerter interface
M2216ACD-1	Basic configuration (with Display)	Any option
M2216ACD-2	No	All configurations

Power Supply Board

The power supply option consists of a Power Supply Board which mounts inside the telephone, coupled with an external wall-mount transformer or closet power supply which provides power to the Power Supply Board. The Power Supply Board receives its power through pins 1 and 6 of the line cord.

The Power Supply Board connects to the telephone through a 14 pin bottom entry connector.

The Power Supply Board comes factory installed with any configuration of the M2016S and M2216ACD-2. The M2006 and M2008 require the Power Supply Board with the addition of any option. The M2616 requires the Power Supply Board with any option except the Display Module.

Local plug-in transformer

A single winding transformer equipped with a 10 ft. (3 m) cord of 22 AWG two-conductor stranded and twisted wire with a modular RJ-11 duplex adapter (Refer to [Figure 13](#) on [page 74](#)) can provide the additional power needed to operate the telephone and its options.

CAUTION

Do not plug any equipment (computer, modem, LAN card) other than the Meridian Modular Telephone into the RJ-11 transformer adapter, as damage to equipment may result.

120 V transformer (AO367335 or equivalent)

The following minimum specifications must be met by this transformer:

- Input voltage
120 V AC / 60 Hz
- No load output voltage
29 V AC maximum
- Voltage at rated current
26.7 V AC minimum
- Rated load current
700 mA

240 V transformer (AO367914 or equivalent)

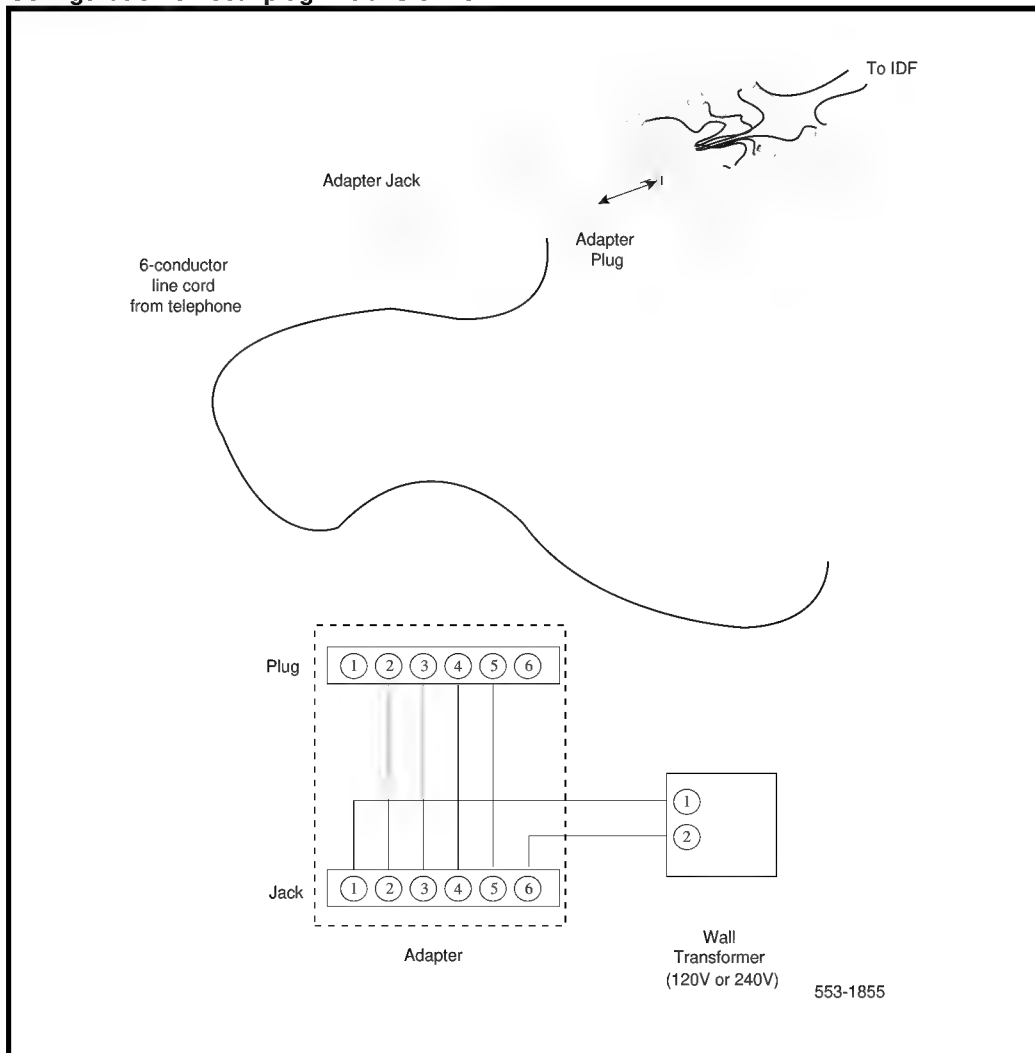
The following minimum specifications have to be met by this transformer:

- Input voltage
240 V AC / 50 Hz
- No load output voltage
29 V AC maximum

- Voltage at rated current
26.7 V AC minimum
- Rated load current
700 mA

Note: You cannot wall mount the telephone over the wall jack when using a transformer, due to the size of the RJ-11 adapter. Mount it above or to the side of the jack and run the line and power cords to it.

Figure 13
Configuration of local plug-in transformer



Closet power supply

Closet power can be obtained from an AC transformer for loops of 100 ft. (30 m) or less, or a DC transformer for loop lengths of 650 ft. (197 m) or less. An equivalent power source can be used but must maintain isolation of outputs to the terminal. (Refer to [Figure 14](#) on [page 76](#)).

CAUTION

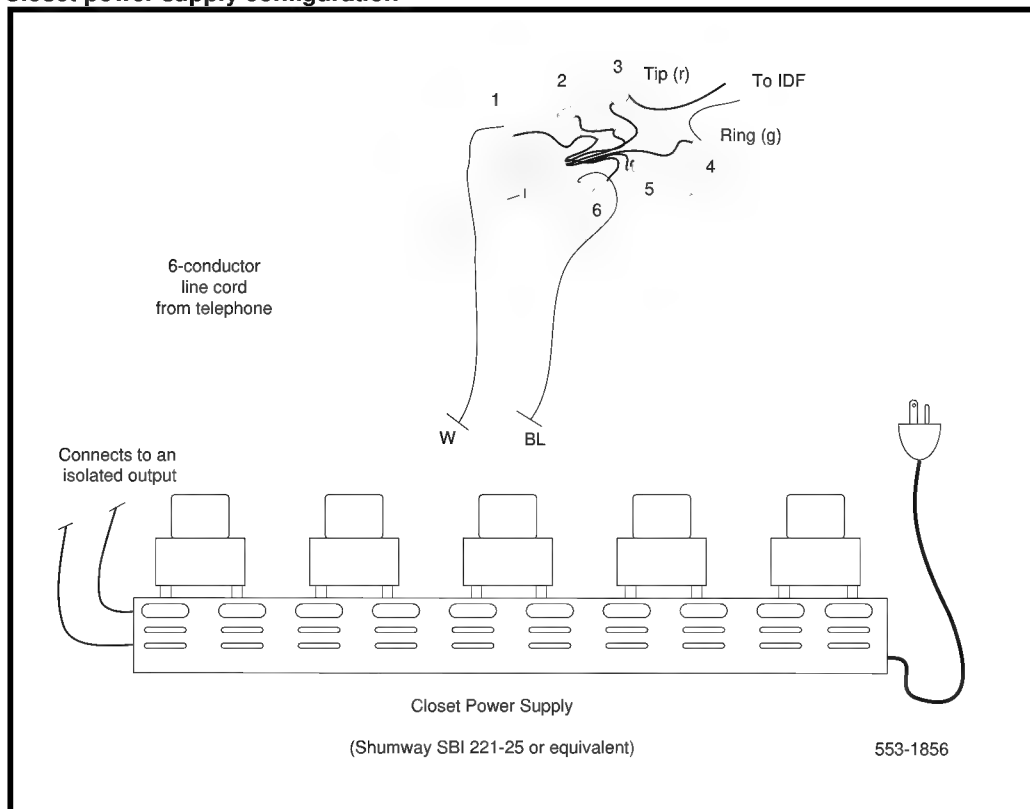
When using closet power, do not plug the TELADAPT connector into any equipment (computer, modem, LAN card) other than the Meridian Modular Telephone, as damage to equipment may result.

All terminals must be isolated from the input winding and each terminal must be isolated from all other terminal windings. A separate winding is required for each terminal, and grounds should not be connected.

Note: The QUT1 closet power supply source is not compatible with Meridian Modular Telephones.

The AC source should be rated at 29 V AC, 700 mA isolated. The DC source should be rated at 42 V DC, 300 mA isolated, with current limiting output of 1 amp.

Figure 14
Closet power supply configuration



Meridian Programmable Data Adapter

When a Meridian Modular Telephone is equipped with the Meridian Programmable Data Adapter (MPDA), you can make a data call using keyboard dialing from your attached terminal. You can carry on voice and data communication simultaneously without causing any mutual interference.

The MPDA communicates with Data Terminal Equipment (DTE) having characteristics as shown in [Table 29](#):

Table 29
MPDA data characteristics

Data type	ASCII
Synchronization	Asynchronous, Start-Stop
Number of Bits	8 bits
Parity	none (unchecked)
Data rate	110, 150, 300, 1200, 2400, 4800, 9600, 19200 bits per second (autobaud)
Stop bits	2 bits for 110 bits per second; 1 bit for all other speeds
Transmission	Full duplex

Note: The MPDA configuration of data parameters is stored locally (although you can set the configuration in the Meridian 1 Option 11C Compact system). You cannot set the data parameters in the system before installing the MPDA in the telephone (the configuration information will be lost).

The keyboard dialing routine may vary with the data equipment being used and reference to the user's data terminal manual may be necessary. For more detailed information, see *Meridian Programmable Data Adapter User Guide* (PO705986).

The MPDA can establish either data calls or voice calls. You can make data calls using keyboard dialing, keypad dialing or the AT command dialing feature. The AT dialing features lets you originate data calls to local and remote Data Terminal Equipment (DTE) directly from a data terminal keyboard or personal computer. You can make voice calls using AT dialing from your terminal.

Users of personal computers already equipped with a Hayes Smartmodem or users who have a stand-alone Hayes Smartmodem can substitute the MPDA for data integration. The Hayes dialing feature, when used with third party communication software and the digital telephone, will support most of the Hayes Smartmodem features. Third party terminal emulation packages can also be used with Hayes dialing.

New features supported by the MPDA include:

- enhanced Hayes commands, including upper- and lower case dialing, voice call origination through AT dialing, hang up data call, and on-line disconnect of voice call
- script file capabilities allow you to program multiple data resources for automatic resource access
- Voice Call Origination (VCO)

Chapter 8 — M2250 Attendant Console

Introduction

The M2250 Attendant Console is to assist in placing and extending calls in and out of the Meridian 1 Option 11C Compact system. It is operated by an attendant as the human interface between the system and the users.

This chapter describes the M2250 attendant console. The M2250 is driven and powered by a digital line card.

Description

Features

The M2250 has the following features:

- A four-line, 40 character, liquid crystal display (LCD) with backlighting and adjustable viewing angle. Power, including backlighting, is maintained during building power failures through the system battery backup, if equipped.
- In shift mode, the M2250 can have up to 20 TGB keys.
- Up to 10 extra flexible feature keys (total of 20) in shift mode
- An optional supporting stand that can be adjusted to nine different positions.
- A handset and headset volume adjustment slider control, situated below the dial pad.
- A physical connection to a serial data port through a subminiature D-type female connector on the console back wall. This permits connection of the console to the serial port of a personal computer.

- An optional Busy Lamp Field/Console Graphics Module (BLF/CGM), which displays the status of up to 150 consecutive extensions (SBLF) or any group of 100 extensions within the system (EBLF), and has many text and graphics capabilities.
- The M2250 provides for transmission level adjustment to meet international requirements by accepting and processing downloaded information from the system (when this messaging is supported in software). The transmission level can be adjusted to one of 16 different levels.
- Angle adjustment of the display screen, which can be tilted through 90° from horizontal to fully vertical
- Scrolling control of lines 2 and 3 of the display screen
- Multi-language selection
- Menus for local console features (options menu) and diagnostics (diagnostics menu)
- Code-blue or emergency relay (associated with ICI 0)
- Time and date system download
- Alert tone volume and frequency selection
- Electret or carbon transmitter support
- Power Fail Transfer switch
- Keyclick

[Figure 15](#) on [page 82](#) shows the top view of the layout of the attendant console with the user-accessible components labeled using a row/column grid arrangement.

[Figure 16](#) on [page 88](#) shows rear, left-hand side, and bottom views of the console. These illustrations show where to find the various components as you read this chapter.

Physical details

The attendant console dimensions are as follows:

- Width
16.75 in. (425 mm)
- Depth
9.5 in. (245 mm)
- Height (front)
1 in. (25 mm)
- Height (back)
2.5 in. (65 mm)
- Height (with display screen panel up)
4.5 in. (115 mm)
- Weight
approximately 6 lb (2.75 kg)

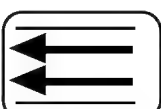
Keyboard layout

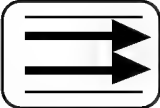
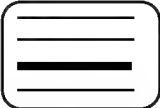
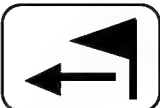
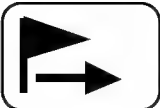
Refer to [Figure 15](#) on [page 82](#) and [Table 30](#) on [page 84](#) for the location of keys and switches.

Function keys

There are eight function keys on the attendant console, located directly below the display screen. Refer to [Table 30](#) on [page 84](#) for the positions, functions, and markings of these keys.

Table 30
Function key definitions and functions

Key number (as shown in Figure 15)	Key	Function of key
(1)		Centralized Attendant Service (CAS) or History Feature key Note: The History feature is not available with Meridian 1 Option 11C Compact.
(2)		Prime function: Position Busy feature Level 1 function (normal): Night Service feature
(3)		Function key 1 (F1) Prime function (normal): Selects display screen line 2 for scrolling. Level 1 function (Shift): Selects the Options menu on the display screen.
(4)		Function key 2 (F2) Prime function (normal): Scrolls the currently selected line to the left Level 1 function (Shift): Decreases the alert speaker volume.

Key number (as shown in Figure 15)	Key	Function of key
(5)		Function key 3 (F3) Prime function (normal): Scrolls the currently selected line to the right Level 1 function (Shift): Increases the alert speaker volume. Refer also to Table 1 page 13 and 2 page 14.
(6)		Function key 4 (F4) Prime function (normal): Selects display screen line 3 for scrolling. Level 1 function (Shift): Selects the Diagnostics menu on the display screen (On the M2250 console, the Diagnostics menu is password-protected. The user must first enter a 4-digit password and press * before the Diagnostics menu is displayed)
(7)		Prime function (normal): Signal Source feature key Level 1 function (Shift): Used with the Busy Lamp Field/Console Graphics Module, as CGM key.
(8)		Prime function (normal): Signal Destination feature key Level 1 function (Shift): Used with the Busy Lamp Field/Console Graphics Module, as the Mode key.
Note: Keys are numbered for identification purposes from 1 to 8 (left to right).		

Switches

A slider switch, located in the bottom row of keys, between columns DI/EI and FI (see [Figure 15](#) on [page 82](#)), controls the handset and headset receive volume level.

The Power Fail Transfer (PFT) switch is located in the baseplate. Both the line connector and the RS-232 connector for the PC port are located at the back of the attendant console.

Shift key

The shift key, mentioned earlier, is positioned in column FK, row 1, just above the Hold key. It is used to access Level 1 mode functions.

Handset and headset jacks

Two jack-pairs are provided for plugging in handsets or headsets. The jacks are located on both sides of the console beneath the faceplate in the recessed area shown by the arrows. The console accepts both carbon and electret headsets and automatically adapts itself to each type.

Note: Electret headsets and handsets are polarity sensitive and must be correctly inserted into the jack.

LCD indicators

The LCD indicators used on the M2250 are half-diamond shaped symbols which normally point towards the key with which they are associated, except in the QMT2 mode of operation and the loop keys where there are two LCDs associated with each key.

Every LCD can flash at 30, 60, and 120 impulses per minute (ipm).

Display screen messages

The following messages may appear on the display screen:

- Source and destination information (line 2 and line 3 respectively)
- MN (minor alarm)
- MJ (major alarm)

- C/H(CAS/History File)
- CW (Call Waiting)
- BUSY(Position Busy)
- NIGHT(Night Service)
- IDLE(Idle)
- ACTIVE(lpik has been selected)
- S (Shift mode)

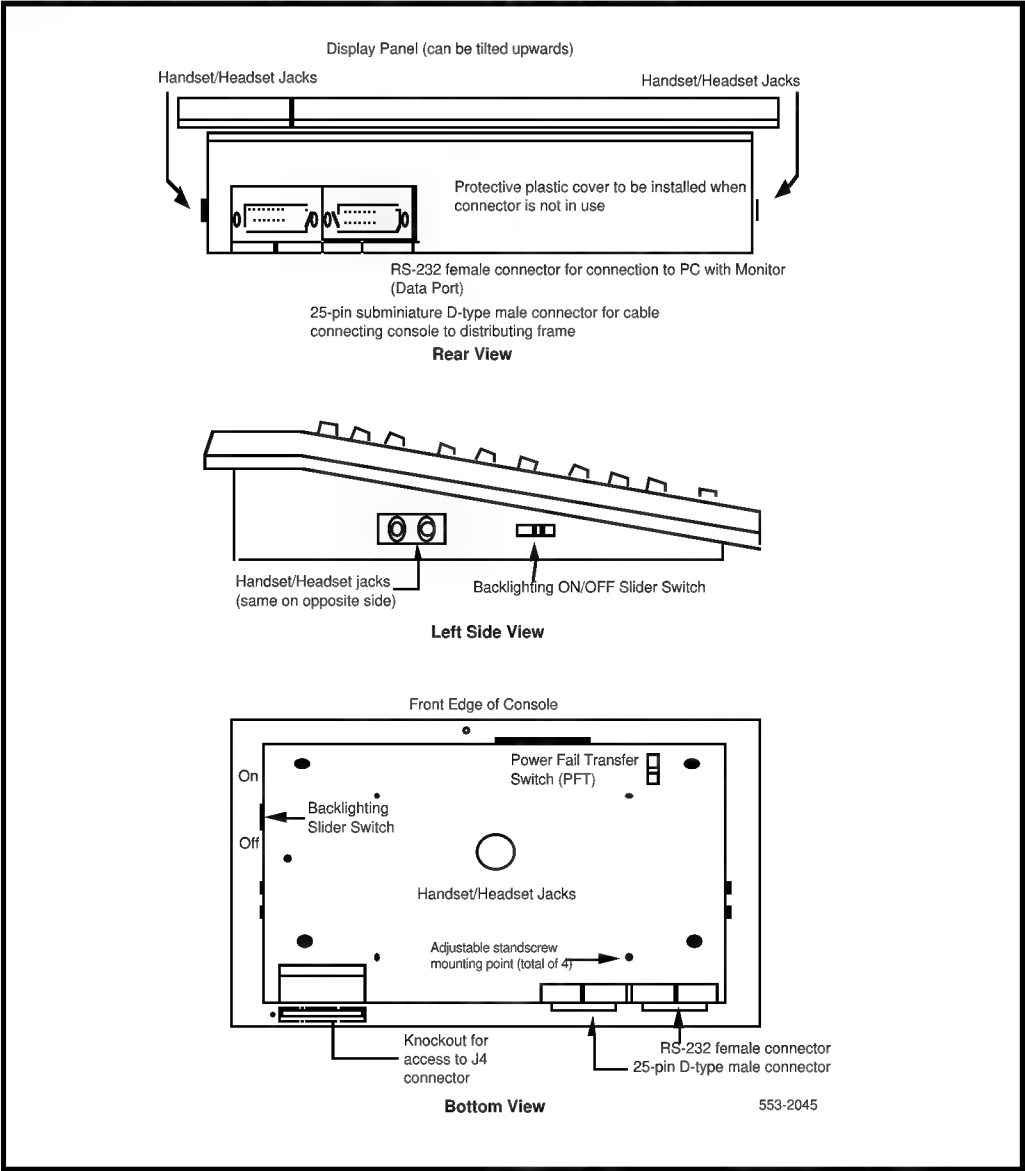
The first four status messages appear as MN, MJ, C/H, and CW on line 4 of the display screen panel. BUSY and NIGHT are combined with the status of the Release lamp to indicate the console status as shown in [Table 31](#).

Table 31
Release lamp indicator status

QCW-type	Indicator	Status	Display screen status (line 4)
Night	Busy	Release	
ON	X	X	NIGHT
OFF	ON	X	BUSY
OFF	OFF	ON	IDLE
OFF	OFF	OFF	ACTIVE
X	X	X	EMERGENCY

If the emergency power fail transfer feature is activated, the console status will be displayed as EMERGENCY.

Figure 16
M2250 attendant console—rear, left side, and bottom views



Connections

The line cord connects to the rear of the attendant console through a 25-pin subminiature D-type connector. The jack connector is attached to the line cord for user safety and equipment protection (pins are not exposed). Having the plug connector mounted in the console also prevents interchanges between the line cord and the serial data port connectors (the serial data port in the console has a jack connector).

A two-prong G3 type connector is provided on both sides of the console body to permit handset or headset connection at either side of the console. The attendant console is compatible with both carbon and electret handsets. The electret handset plug is orientation-dependent and is labeled accordingly.

The M2250 attendant console is connected to the system through two TNs (primary and secondary) with two additional TNs for powering. Two additional units may be used for long line loop powering.

The M2250 console requires a Digital Line Card (DLC).

Local console controls

The display screen contrast on the attendant console can be adjusted using the Contrast option on the Options menu.

The pitch and volume of the buzz tone on the console can be adjusted by the user.

You can choose any one of eight languages (English, French, Spanish, German, Italian, Norwegian, Gaelic, or Turkish) for the console screen displays.

The attendant console is equipped with a real time clock/calendar. The time of day (hours, minutes, and seconds) and the date (day, month, and year) are displayed on line 1 of the display screen.

The user can turn the sound of key click on or off. On the M2250, the user can adjust the pitch and volume of the key click.

Busy Lamp Field/Console Graphics Module Busy Lamp Field/Console Graphics Module

The Busy Lamp Field/Console Graphics Module (BLF/CGM) can be added to an M2250 attendant console.

The BLF/CGM can:

- display the status (busy or idle) of up to 150 consecutive extensions within the system (SBLF)
- display the status of any hundreds group of DN's within the system (EBLF)
- display which attendant console is the supervisory console, and which consoles are active
- display supplementary information about individual extensions, such as the reason the person is away (business, vacation, or illness), when the person is due to return, and an alternate extension where calls to the person should be directed
- display a company logo
- display graphics
- display text in any one of eight languages
- have its screen contrast adjusted for easy viewing

Installation

The BLF/CGM mounts on the back of the attendant console and is held on using snapfits and two screws. It is connected to the console using a 15-way connector that is located on the keyboard printed circuit board (PCB). This connector is accessed through a rectangular knockout section located underneath the casing overhang at the Meridian logo location (see [Figure 16](#) on [page 88](#)).

For more information on the features and operation of the BLF/CGM, refer to the *Busy Lamp Field/Console Graphics Module User Guide* (P0706875).

Power requirements

The BLF/CGM obtains its power through the attendant console.

An external floating 16 V DC (300 mA) power supply (transformer—A0367601) must be cabled in at the local cross-connect terminal at a maximum of 115 ft. (35 m) from the attendant console when the BLF/CGM is installed. This provides backlighting for the BLF/CGM.

Chapter 9 — NTMW05 Digital Line Card

Description

In the Meridian 1 Option 11C Compact systems the NTMW05 Digital Line Card can be installed in any Peripheral Equipment (PE) slot in the main (Slots 1 through 9) and in the expansion cabinet (slots 11 through 19).

The NTMW05 Digital Line Card is a voice and data communication link between the system and Meridian Digital Telephones. It supports voice only or simultaneous voice and data service over a single twisted pair of standard telephone wiring.

When a digital telephone is equipped with the data option, an asynchronous ASCII terminal or personal computer can be connected to the system through the digital telephone.

Physical

The digital line card circuitry is contained on a mini double-sided printed circuit board. The card connects to the backplane through an edge connector.

The faceplate of the card is equipped with a 50-pin connector allowing it to be cabled to the cross-connect terminal (main distribution frame) using 25-pair cable. Station apparatus then connects to the card at the cross-connect terminal.

Also located on the faceplate of the digital line card is a red light emitting diode (LED) which lights when the card is disabled. At power-up, the LED flashes as the digital line card runs a self-test. If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

Functional

The digital line card is equipped with 24 voice ports (units 0 through 23), eight of which are integrated data ports (units 24 through 31 associated with units 8 through 15). Each unit provides a multiplexed voice and signaling path to and from digital apparatus over a 2-wire full duplex 512 kHz time compression multiplexed (TCM) digital link. The integrated ports include data capabilities.

The digital line card contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

Technical summary

[Table 32](#) provides a technical summary of the digital line card.

Table 32
NTMW05 Digital Line Card technical summary

Characteristics	Description
Units per card	24 voice, 8 data
Impedance	100 Ω
Loop limits	0 to 3500 ft (1070 m) with 24 AWG cable (+15 V DC at 80 mA) 0 to 2450 ft (745 m) with 26 AWG cable
Line rate	512 kbps + 100 ppm
Power supply	+ 5 V DC $\pm$ 15 V DC +10 V DC
Transmitter output voltage:	
—successive “1” bits	$+1.5 \pm 0.15$ V and -1.5 ± 0.15 V
—“0” bits	0 ± 50 mV

Power requirements

The digital line card needs ± 15 V DC over each loop at a maximum current of 80 mA. It requires +15V, - 15V, and +5V from the backplane. The line feed interface can supply power to one loop of varying length up to 3500 ft (1070 m) using 24 AWG wire with a maximum allowable AC signal loss of 15.5 dB at 256 kHz, and a maximum DC loop resistance of 210 ohms; 26 AWG wire is limited to 2450 ft (745 m).

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the Digital line card.

Chapter 10 — NTMW06 Analog Line Card

Description

The NTMW06 16 Port Analog Line Card used in the Entrepreneur system provides talk battery and signaling for 16 common battery 500-type (rotary dial) and 2500-type (Digitone dial) telephones and key telephone equipment. It also equipped with the message waiting indicator feature.

The NTMW06 Analog Line Card interfaces to and is compatible with the equipment listed in [Table 33](#) on [page 98](#).

Table 33
NTMW06 Analog Line Card compatibility

Equipment	Specifications
500 type rotary dial sets (or equivalent): dial speed percent break interdigital time	8.0 to 12.5 pps 58 to 70% 150 ms
2500 type Digitone sets (or equivalent): frequency accuracy pulse duration interdigital time speed	$\pm 1.5\%$ 40 ms 40 ms 12.5 digits/s

Physical

The NTMW06 Analog Line Card is a half height card which can be installed in slots 1 through 9 in the main cabinet and slots 11 through 19 in the expansion cabinet.

The line card circuits connects to the backplane through an edge connector.

The the faceplate of the card is equipped with a 50-pin connector allowing it to be cabled to the cross-connect terminal (main distribution frame) using 25-pair cable. Station apparatus then connects to the card at the cross-connect terminal.

Also located on the faceplate of the NTMW06 Analog Line Card is a red light emitting diode (LED) which lights when the card is disabled. At power-up, the LED flashes as the analog line card runs a self-test. If the test completes successfully, the card is automatically enabled (if it is configured in software) and the LED goes out.

Functional

The NTMW06 Analog Line Card contains a microprocessor that provides the following functions:

- self-identification
- self-test
- control of card operation
- status report to the controller
- maintenance diagnostics

The analog message waiting line card also provides:

- 600-ohm balanced terminating impedance
- analog-to-digital and digital-to-analog conversion of transmission and reception signals for 16 audio phone lines
- transmission and reception of scan and signaling device (SSD) signaling messages over a DS30X signaling channel in A10 format
- on-hook/off-hook status and switchhook flash detection
- 20-Hz ringing signal connection and automatic disconnection when the station goes off-hook
- synchronization for connecting and disconnecting the ringing signal to zero crossing of ringing voltage
- loopback of SSD messages and pulse code modulation (PCM) signals for diagnostic purposes
- correct initialization of all features at power-up
- direct reporting of digit dialed (500-type telephones) by collecting dial pulses
- connection of -150 V DC at 1 Hz to activate message waiting lamps
- lamp status detection
- disabling and enabling of selected units for maintenance

Technical summary

Analog line interface

Input impedance

The impedance at tip and ring is 600 ohms with a return loss of

- 20 dB for 200-500 Hz
- 26 dB for 500-3400 Hz

Insertion loss

On a station line-to-line connection, the total insertion loss at 1 kHz is 6 dB $\pm$ 1 dB. This is arranged as 3.5 dB loss for analog to PCM, and 2.5 dB loss for PCM to analog.

Frequency response

The loss values in [Table 34](#) are measured relative to the loss at 1 kHz.

Table 34
NTMW06 Analog Line Card frequency response

Frequency	Minimum	Maximum
60 Hz	20.0 dB	--
200 Hz	0.0 dB	5.0 dB
300 Hz	-0.5 dB	1.0 dB
3000 Hz	-0.5 dB	1.0 dB
3200 Hz	-0.5 dB	1.5 dB
3400 Hz	0.0 dB	3.0 dB

Message channel noise

The message channel noise C-weighted (dBrnC) on 95 percent of the connections (line to line) with both ends terminated in 600 ohms does not exceed 20 dBrnC.

[Table 35](#) provides a technical summary of the analog message waiting line card.

Table 35
NTMW06 Analog Line Card technical summary

Impedance	600 Ω
Loop limit (excluding set)	1000 Ω at nominal -48 V (excluding set)
Leakage resistance	30,000 Ω
Ring trip	During silent or ringing intervals
Ringing voltage	86 V AC
Signaling	Loop start
Supervision	Normal battery conditions are continuously applied (approximately -44.5 V on ring and -2.5 V on tip at nominal -48 V battery)
Power input from backplane	-48 (minimum -42), +15, -15, +8.5 V and ringing voltage; also -150 V on analog message waiting line card.
Insertion loss	6 dB $\pm$ 1 dB at 1020 Hz 3.5 dB loss for analog to PCM, 2.5 dB loss for PCM to analog

Power requirements

[Table 36](#) provides the power requirements for the NTMW06 Analog Line Card.

Table 36
Power requirements

Voltage (+/-)	Tolerance	Idle current	Active current	Max
+ 12.0 V DC	0.36 V DC	48 mA	0 mA	48 mA
+ 8.0 V DC	0.40 V DC	150 mA	8 mA	280 mA
- 48.0 V DC	2.00 V DC	48 mA	40 mA	688 mA
- 48.0 V DC	5.00 V DC	0 mA	10 mA (Note 1)	320 mA
86.0 V AC	5.00 V AC	0 mA	10 mA (Note 2)	160 mA
-150.0 V DC	3.00 V DC	0 mA	2 mA	32 mA

Note 1: Each active ringing relay requires 10 mA of battery current.

Note 2: Reflects the current for ringing a single station set. There may be as many as five ringers on each line.

Foreign and surge voltage protections

In-circuit protection against power line crosses or lightning is not provided on the NTMW06 Analog Line Card. When the Analog line card is used to service off-premise telephones, the NTAK92 Off-premise protection module must be used. Check local regulations before providing such service.

Overload level

Signal levels exceeding +7 dBm applied to the tip and ring cause distortion in speech transmission.

Chapter 11 — NTMW07 Trunk/Line Card

Introduction

The NTMW07 Trunk/Line mini card is a combined 4 Port analog line and 4 Port analog trunk card designed for use in the Meridian 1 Option 11C Compact system.

Description

The NTMW07 Trunk/Line Card has eight unit; four analog line units and four analog trunk units.

The the four line units on the NTMW07 Trunk/Line card are identical to those on the NTMW06 Analog Line card (see "Chapter 10 —NTMW06 Analog Line Card" on page 97 for a description). However, unlike the NTMW06 Analog Line card, The NTMW07 is equipped with a Power Fail Transfer (PFT) feature on one line unit. ([See "Power Fail Transfer" on page 108.](#))

The trunk portion of t he NTMW07 Trunk/Line Card has the following features:

- trunk type can be configured on a per unit basis
- indicates status during an automatic or manual self-test
- provides card-identification for auto configuration, and to determine the serial number and firmware level of the card
- converts transmission signals from analog-to-digital/digital-to-analog
- operates in A-Law or μ -Law companding modes on a per unit basis
- provides software selected terminating impedance (600, 900, or 1200 ohm) on a per unit basis (1200 ohm supported for RAN trunks only)
- provides software selected balance impedance (600 ohm or complex impedance network) on a per unit basis

- interfaces four PCM signals to one DS-30X timeslot in A10 format
- transmits and receives SSD signaling messages over a DS-30X signaling channel in A10 format
- supports PCM signal loopback to DS-30X for diagnostic purposes.
- is equipped with Power Fail Transfer (PFT)

Trunk types supported

The four trunk units on the card support the following types of trunks:

- Central Office (CO), Foreign Exchange (FX), and Wide Area Telephone Service (WATS)
- Direct Inward Dial (DID) and Direct Outward Dial (DOD)
- Tie Two-way Dial Repeating (DR) and Two-way Outgoing Automatic Incoming Dial (OAID)
- Paging (PAG)

Note: All-call zone paging is not supported.

- Recorded Announcement (RAN).

The NTMW07 Trunk/Line Card also supports Music and Direct Inward System Access (DISA).

[Table 37](#) is a matrix of the trunk types and signaling supported by the NTMW07 Trunk/Line Card.

Table 37
Supported trunk type and signaling matrix

	CO/FX WATS	DID/ DOD	Tie	PAG	RAN
Loop start	yes	no	no	no	no
Ground start	yes	no	no	no	no
Loop dial repeating	no	yes	yes	no	no
Loop OAID	no	no	yes	no	no

Electrical characteristics

Electrical characteristics of the NTMW07 Trunk/Line Card are listed in [Table 38](#).

Table 38
NTMW07 Trunk/Line Card electrical characteristics

Characteristic	DID trunk	CO trunk
Terminal impedance	600 or 900 Ω (selected by software)	600 or 900 Ω (selected by software)
Signaling range	2450 Ω	1700 Ω
Signaling type	Loop start	Ground or loop start
Far end battery	- 42 to - 52.5 V	- 42 to - 52.5 V
Near end battery	N/A	- 42.75 to - 52.5 V
Minimum loop current	N/A	20 mA
Ground potential difference	± 3 V	± 3 V
Low DC loop resistance during outpulsing	N/A	< 300 Ω
High DC loop resistance	N/A	Ground start equal to or greater than 30k Ω ; loop start equal to or greater than 5M Ω
Line leakage	Equal to or greater than 30k Ω (Tip to Ring, Tip to ground, Ring to ground)	Equal to or greater than 30k Ω (Tip to Ring, Tip to ground, Ring to ground)
Effective loss	See PAD switching	See PAD switching

Physical characteristics

When the card is installed, the red Light Emitting Diode (LED) on the faceplate flashes as the self-test runs. If the self-test completes successfully, the card is automatically enabled (if it is configured in software) and the LED extinguishes. If the self-test fails, the LED remains lit. The LED will also remain lit if one or more units on the card become disabled after the card is operating.

Each unit on the card connects to the backplane through an edge connector. The faceplate of the card is equipped with a 50-pin Amphenol-type connector for cabling to the cross-connect terminal.

At the cross-connect terminal, each trunk unit connects to external apparatus, such as Central Office facilities or Recorded Announcement equipment. Each line unit connects to analog (500/2500-type) telephones as described in "Chapter 10 —NTMW06 Analog Line Card" on page 97.

Slot assignments

The NTMW07 can only be installed in slots 1 & 2, 3 & 4 and 5 & 6 in the main cabinet, and in slots 11 & 12, 13 & 14 and 15 & 16 in the expansion cabinet. The system recognizes trunk card portion as an odd numbered card assignment (cards 1, 3, 5, 11, 13, 15) and the line card portion as even numbered card assignment (cards 2, 4, 6, 12, 14, 16). [Table 39](#) on [page 107](#) shows the Terminal Assignments (TN) for each card slot.

Table 39
NTMW07 Trunk/Line Terminal Number Assignments

Card Slot	Card Assignment	First TN.....Last TN	Type of Unit	Cabinet
1 & 2	1	01 00.....01 03	Trunk	Main
	2	02 00.....02 03	Line	Main
3 & 4	3	03 00.....03 03	Trunk	Main
	4	04 00.....04 03	Line	Main
5 & 6	5	05 00.....05 03	Trunk	Main
	6	06 00.....06 03	Line	Main
7	7	—		Main
8	8	—		Main
9	9	—		Main
10		—		Main
11 & 12	11	11 00.....11 03	Trunk	Expansion
	12	12 00.....12 03	Line	Expansion
13 & 14	13	13 00.....13 03	Trunk	Expansion
	14	14 00.....14 03	Line	Expansion
15 & 16	15	15 00.....15 03	Trunk	Expansion
	16	16 00.....16 03	Line	Expansion
17	17	—		Expansion
18	18	—		Expansion
19	19	—		Expansion
	20	Not used		Expansion

Power Fail Transfer

The NTMW07 Trunk/Line card has a built-in Power Failure Transfer (PFT) feature, designed to operate with a loop start trunk. This feature allows the connecting one trunk on the card to an analog telephone on the same card in the event of a commercial power or system failure.

Note: Ground start trunks require a telephone set equipped with a ground start button to place outgoing calls when in PFT mode.

The Terminal Numbers (TNs) that are equipped to perform the PFT function vary depending on the slot assignment in the cabinets. When a PFT occurs, the following are connected:

- **In the Main cabinet**
 - When the NTMW07 card is in slot 1 & 2
TN 01 03 connects to TN 02 03
(Trunk on Card 01 Unit 03 connects to the telephone on Card 02 Unit 03)
 - When the NTMW07 card is in slot 3 & 4
TN 03 03 connects to TN 04 03
(Trunk on Card 03 Unit 03 connects to the telephone on Card 04 Unit 03)
 - When the NTMW07 card is in slot 5 & 6
TN 05 03 connects to TN 06 03
(Trunk on Card 05 Unit 03 connects to the telephone on Card 06 Unit 03)
- **In the Expansion cabinet**
 - When the NTMW07 card is in slot 11 & 12
TN 11 03 connects to TN 12 03
(Trunk on Card 11 Unit 03 connects to the telephone on Card 12 Unit 03)
 - When the NTMW07 card is in slot 13 & 14
TN 13 03 connects to TN 14 03
(Trunk on Card 13 Unit 03 connects to the telephone on Card 14 Unit 03)

- When the NTMW07 card is in slot 15 & 16
TN 15 03 connects to TN 16 03
(Trunk on Card 15 Unit 03 connects to the telephone on Card 16 Unit 03)

Power requirements

Power requirements for the NTMW07 Trunk/Line Card are shown in [Table 40](#).

Table 40
Power requirements

Voltage	Tolerance	Idle current	Active current
± 15.0 V DC	± 5%	306 ma	306 ma
+ 8.5 V DC	± 2%	120 ma	120 ma
- 48.0 V DC	± 5%	346 ma	346 ma
+ 5.0 V DC	± 10%	350 ma	350 ma

Environmental specifications

[Table 41](#) lists the environmental specifications for the Universal Trunk Card.

Table 41
Environmental specifications

Parameter	Specifications
Operating temperature	0 to 50 degrees C, ambient
Operating humidity	5 to 95% RH (non-condensing)
Storage temperature	- 40 to + 70 degrees C

Foreign and surge voltage protection

The Universal Trunk Card meets CS03 overvoltage (power cross) specifications.

Release control

Release control establishes which end of a call (near, far, either, joint, or originating) disconnects the call. Only incoming trunks in idle ground start configuration can provide disconnect supervision. You configure release control for each trunk independently in the Route Data Block (LD 16).

PAD switching

The transmission properties of each trunk are characterized by the class-of-service (COS) assigned in the Trunk Data Block (LD 14). Transmission properties may be via net loss (VNL) or non via net loss (non-VNL).

Non-VNL trunks are assigned either a Transmission Compensated (TRC) or Non-Transmission Compensated (NTC) class-of-service to ensure stability and minimize echo when connecting to long-haul trunks, such as Tie trunks. The class-of-service determines the operation of the switchable PADs contained in each unit. They are assigned as follows:

- Transmission Compensated
 - used for a two-wire non-VNL trunk facility with a loss of greater than 2 dB for which impedance compensation is provided
 - or used for a four-wire non-VNL facility
- Non-Transmission Compensated
 - used for a two-wire non-VNL trunk facility with a loss of less than 2 dB
 - or used when impedance compensation is not provided

[Table 42](#) shows PAD settings and the resulting port-to-port loss for trunk connections between the NTMW07 Trunk/Line Card and any other Peripheral Equipment (PE) unit, denoted as Port B

In Meridian 1 Option 11C Compact systems, the insertion loss from PE ports to PE ports is as follows.

Table 42
Insertion Loss from PE Ports to PE Ports (measured in dB)

	PE Ports					
	500/2500 Line		Digital Line		CO/FX /WATS Loop Tie Trunk	
PE Ports	↑	↓	↑	↓	↑	↓
CO/FX/WATS Loop Tie Trunk						
→	2.5		0		0.5	
←		0		-3.5		0.5

Application

The optional applications, features, and signaling arrangements for each trunk are assigned through route and trunk data blocks.

Loop start operation

Loop start operation is configured in software. When the Universal Trunk is idle, it provides a high impedance toward the CO for isolation and AC detection. The alerting signal is 20 Hz ringing sent by North American CO. When an incoming call is answered, ringing is tripped when the trunk places a low resistance DC loop towards the CO.

For outgoing calls from a telephone set or attendant console, software sends an outgoing seizure message to place a low resistance loop across the Tip and Ring leads towards the CO. When the CO is ready to receive digits, it returns dial tone. The outward address signaling is applied from the system in the form of DTMF tones or dial pulses.

Ground start operation

Ground start operation is configured in software. In an idle state, the Tip conductor from the CO is open and a high resistance negative battery is present on the Tip of the trunk. This biases the Tip ground detector OFF until the CO places ground on the Tip at seizure. After the Tip ground is detected, the NTMW07 Trunk/Line Card scans for a ringing detection signal before presenting the call to an attendant and tripping the ringing. A low resistance is placed across the Tip and Ring conductors and a speech path is established.

Direct Inward Dial operation

An incoming call from the CO places a low resistance loop across the Tip and Ring leads. Dial pulses or DTMF signals are then presented from the CO. When the call is presented and the terminating party answers, the NTMW07 Trunk/Line Card reverses battery and ground on the Tip and Ring leads to the CO. The trunk is arranged for first party release. The CO releases the trunk by removing the low resistance loop and normal battery and ground are restored at the system.

Tie Two-way Dial Repeating operation

In an incoming call configuration, the far end initiates a call by placing a low resistance loop across the Tip and Ring leads. This causes a current to flow through the battery feed resistors in the trunk circuit. Address signaling is then applied by the far end in the form of DTMF tones or dial pulses. When the called party answers, an answer supervision signal is sent by software, causing the trunk to reverse battery and ground signals to the far end. The far end then removes the low resistance loop and normal battery and ground are restored at the system.

In an outgoing call configuration, the trunk is connected to another PBX by a Tie trunk. An outgoing call from the system seizes the trunk facility by placing a low resistance loop across the Tip and Ring leads. Outward addressing is then applied from the system in the form of DTMF tones or dial pulses (battery/ground pulsing). If answer supervision is provided by the far end, reverse battery is received, which provides a disconnect supervision signal.

Tie Outgoing Automatic Incoming Dial operation

When the trunk is seized by the far end on an incoming call, a low resistance loop is placed across the Tip and Ring leads. Dial pulses are sent by the far end by interrupting the loop current. The trunk is released at the far end when the loop is opened. When it detects an open loop, the near end reverts to a normal state.

When seized as a dial-selected outgoing trunk, the NTMW07 Trunk/Line Card places battery on the Tip and ground on the Ring. This alerts the far end of the seizure. The far end responds with a low resistance across the Tip and Ring leads.

Recorded Announcement operation

In this mode of operation, the trunk is connected to a digital announcement machine. The announcer provides a number of channels and operates in a continuous mode, generating 150-300 ms common control pulses every 7 or 14 seconds (at the start of the announcement period). A number of trunks can be connected to one announcement machine.

The NTMW07 Trunk/Line Card does not support the Code-A-Phone 210DC announcement recorder.

Paging operation

In the Paging mode, the trunk is connected to a customer-provided paging amplifier system. When the trunk is accessed by dial-up or attendant key operation, it provides a loop closure across control leads A and B. In a typical application, this transfers the input of the paging amplifier system to the transmission path of the trunk.

Chapter 12 — NTMW04 1.5 Mb DTI/PRI

Introduction

The NTMW04 is a mini Peripheral Equipment (PE) circuit card that installs in any of the upper three peripheral slots in the main cabinet of the Meridian 1 Option 11C Compact system. It provides 1.5Mb ISDN Primary Rate Interface and Digital Trunk Interface capabilities. The NTMW04 also provides Clock recovery (slave configuration) and a D-Channel Handler Interface (downloadable).

Functional description

The NTMW04 provides the following features and functions:

- 1.544 Mbps T1 transmission rate
- D2, D3, D4, and ESF framing formats
- Line Equalization via software control
- selection of B7 and B8ZS method of zero code suppression
- support of the NI-2 TR-1268 interface
- support of the NX64 feature
- 1.5 Mb Clock recovery, in a slave configuration format
- support of in band ABCD signaling for DTI applications
- AMI or B8ZS line coding
- CE-MUX for D-Channel communication
- downloadable layer 1 software and DTI software
- downloadable D-Channel Hardware Interface software

- transmission line performance monitoring and Fault Management with Alarm reporting
- downloadable PAD value for Loss level control and A-law/Mu-law conversion
- Elastic Buffer for Slip Control
- alarm detection and generation
- Uniform Delay on all time slots in Nx64 formats

Physical description

LEDs

The NTMW04 has eight faceplate LEDs. The first six LEDs are associated with the NTMW04 card itself, and the remaining two LEDs are associated with the clock controller and DCHI daughterboards.

In general, the first six LEDs operate as follows:

- During system power up, the LEDs are on.
- When the self-test is in progress, the LEDs flash on and off three times, then go into their appropriate states, as shown in [Table 43](#).

Table 43
NTMW04 LED states

LED	State	Definition
DIS	On (Red)	The NTMW04 circuit card is disabled.
	Off	The NTMW04 is not in a disabled state.
ACT	On (Green)	The NTMW04 circuit card is in an active state. No alarm states exist, the card is not disabled, nor is it in a loopback state.
	Off	An alarm state or loopback state exists, or the card has been disabled. See the other faceplate LEDs for more information.
RED	On (Red)	A red-alarm state has been detected.
	Off	No red alarm.
YEL	On (Yellow)	A yellow alarm state has been detected.
	Off	No yellow alarm.
LBK	On (Green)	NTMW04 is in loop-back mode.
	Off	NTMW04 is not in loop-back mode.
DCH	On (Red)	D Channel is disabled.
	On (Green)	D Channel is enabled.
CC	On (Green)	The NTMW04 is locked to a reference or is in free run mode.
	Flashing (Green)	The NTMW04 is in tracking mode.
	Off	The NTMW04 is not equipped
	On (Red)	The NTMW04 is not equipped.

Foreign and surge voltage protection

Lightning protectors must be installed between an external T-1 carrier facility and the Meridian 1 Option 11C Compact cabinet. For public T-1 facilities, this protection is provided by the local operating company. In a private T-1 facility environment, the NTAK92 protection assembly may be used.

The NTMW04 circuit card conforms to safety and performance standards for foreign and surge voltage protection in an internal environment.

Architecture

Signaling interface

The signaling interface performs an 8 Kbps signaling for all 24 channels and interfaces directly to the DS-30X link. Messages in both directions of transmission are three bytes long.

Interconnection

The interconnection to the carrier is by NTMW37 1.5Mb carrier cable (A0681162).

The A0681162 is 20 feet long. The NT8D97AX, a fifty-foot extension, is also available if required.

Digital pad

The digital pad is an EPROM whose address-input to data-output transfer function meets the characteristics of a digital attenuator. The digital pad accommodates both u255-law and A-law coding. There are 32 combinations (see [Table 44](#)) each for u255 to u255, u255 to A-law, A-law to u255, and A-law to A-law. These values are selected to meet the EIA loss and level plan and are set in LD 73 (refer to the Meridian 1 Option 11C Compact *1.5Mb DTI/PRI Guide*).

Table 44
Digital pad values and offset allocations

Offset	PAD set 0	PAD set 1
0	0dB	-7db
1	2dB	-8db
2	3dB	-9db
3	4dB	-10db
4	5dB	0.6db
5	6.1dB	7db
6	8dB	9db
7	-1dB	10db
8	-3dB	11db
9	-4dB	12db
A	idle code, 7F	3db
B	unassigned code, FF	14db
C	1dB	spare
D	-2dB	spare
E	-5db	spare
F	-6db	spare

D-Channel Interface

Feature selection through downloadable D-Channel Interface software configuration for the D-Channel includes:

- 56 Kbps
- 64 Kbps clear
- 64 Kbps inverted (64 Kbps restricted)

Clock controller interface

The purpose of the clock controller interface is to provide the recovered clock from the external digital facility to the CPU pack. Depending on the equipped state of the clock controller, the clock controller interface enables or tri-states the reference clock source, in conjunction with software.

Circuitry within an EPLD will emulate the control and status register bits needed for the clock controller interface. No secondary reference will be allowed, and the primary reference will be the equipped clock controller.

Mode of operation

T1TE settings

The T1 Transmit Equalization is set in LD 17 using the T1TE prompt. It can be set in four different modes (0, 1, 2, 3) as shown in [Table 45](#). Refer to the Meridian 1 Option 11C Compact *1.5Mb DTI/PRI Guide* for further details.

Table 45
Transmit Equalization Settings (LD 17)

T1TE Setting	Distance
0 (default)	0-133 ft
1	134-266 ft
2	267-399 ft
3	400-655 ft

Primary Reference Clock card setting

The Primary Reference Clock card is set in LD 73 using the PREF prompt. Refer to the Meridian 1 Option 11C Compact *1.5Mb DTI/PRI Guide* for further details.

Chapter 13 — Fiber optic cable and interfaces

Introduction

This chapter describes the fiber optic cable interface equipment used with the Meridian 1 Option 11C Compact system.

Through the use of fiber optic cable and fiber optic cable interfaces, the expansion cabinet can be located up to 33 ft (10 m) from the main cabinet.

Fiber optic cable interfaces

Fiber optic interface hardware used with Meridian 1 Option 11C Compact consists of an NTDK22 Fiber Expansion daughter board and an NTMW10 Fiber Receiver card mounted in the expansion cabinet.

NTDK22 Fiber Expansion daughter board

The NTDK22 Fiber Expansion daughter board mounts on the NTMW01 SSC card allowing the connection of an A0632902 Plastic Fiber Optic cable to an expansion cabinet up to 33 ft (10 m) from the main cabinet.

Note: The A0632902 Plastic Fiber Optic cable is the only fiber optic cable supported by the Meridian 1 Option 11C Compact system.

NTMW10 Fiber Receiver card

The NTMW10 Fiber Receiver card is a full size circuit card which is installed in the first slot of an expansion cabinet. It connects to the A0632902 Plastic Fiber Optic cable from the main cabinet.

Plastic Fiber Optic cable

The A0632902 Fiber Optic cable is a 33 ft (10 m) plastic fiber optic cable. It is equipped with a connector on each end which connect to the NTDK22 Daughter Board in the main cabinet and to the NTMW10 Fiber Receiver card in the expansion cabinet. This cable, which is the only cable that can be used for this purpose, cannot be cut or altered.

Environment

The Daughter Boards and Receiver cards are subject to the environmental conditions shown in Table [46](#).

Table 46
Environmental conditions

	Operating	Storage
Ambient temperature	0° C to 50° C (32° F to 122° F)	-45° C to 70 ° C (-49° F to 158° F)
Relative Humidity	5% to 95%	0% to 95%

Meridian 1

Option 11C Compact

Technical Reference Guide

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About this guide

This *Technical reference guide* contains detailed technical information about the Meridian 1 Option 11C Compact system. It includes such things as:

- circuit cards information
- spares planning
- SDI ports information
- transmission parameters
- Meridian modular telephone sets
- M2250 attendant console

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Meridian 1

Option 11C Compact

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